

the **TOOL ENGINEER**

SEPTEMBER 1959



brazing

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

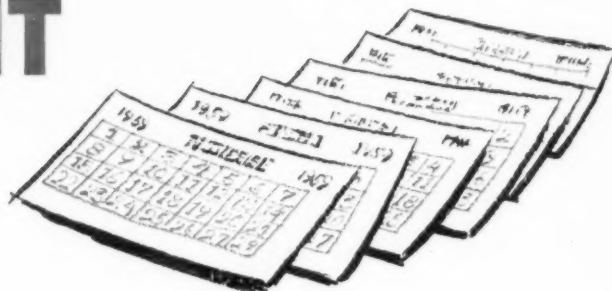
WHY WAIT

longer

for a new machine?

Chances are, Heald has it

IN STOCK!



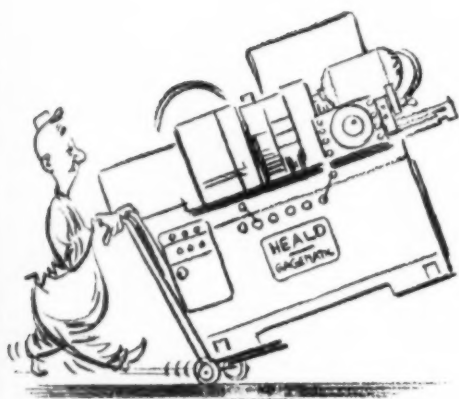
As a result of Heald's recently instituted stock machine program, the most popular types and sizes of Heald precision finishing machines are normally carried in factory stock at Worcester. Any time you can buy a *stock machine*, and supply your own fixtures and tooling, you get these important advantages...

1. FAST DELIVERY. Instead of waiting for several months for a specially built machine, your stock machine will be on its way in a matter of days or weeks.

2. LOWER COST. By eliminating special engineering and drafting, you get a top-quality basic machine at lowest possible cost.

3. UNLIMITED VERSATILITY. Every Heald stock machine has the inherent versatility of speeds, feeds and cycling that permits easy adaptability to virtually any combination or sequence of operations.

If you need a standard machine in a *hurry* — and at minimum cost — it will pay you to check Heald on the availability of a *stock machine* that will meet your requirements.

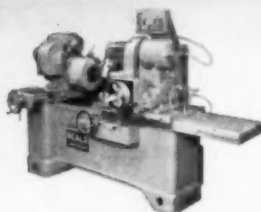


THESE STANDARD HEALD MACHINES ARE NORMALLY CARRIED IN STOCK



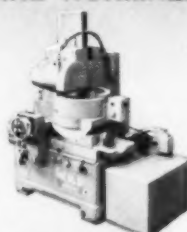
BORE-MATICS

Model "0"	Model 421
Model 121	Model 222
Model 221	Model 322
Model 321	Model 422



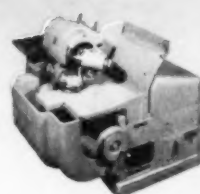
INTERNAL GRINDERS

Model 171 Size-Matic
Model 171 Gage-Matic
Model 271 Plain
Model 271 Size-Matic
Model 271 Gage-Matic
Model 271 Tool Room
Model 272 Basic
Model 273A Universal



ROTARY SURFACE GRINDERS

Model 161 6"
Model 261 16" Plain
Model 261 16" Automatic
Model 361 24" Plain
Model 361 24" Automatic



TOOL SHARPENING MACHINES

Model 3
Model 4



THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York • Syracuse

the tool engineer

Vol. 43, No. 3

September 1959

Creative Manufacturing
IS
TOOL ENGINEERING

Can You Afford Numerical Control?	<i>By Myron S. Curtis</i>	79
Control of machines by tape of punched cards can result in spectacular savings or spectacular losses, depending on the job.		
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Piercing with Nuts Cuts Fastening Costs.	<i>By John H. Steward</i>	85
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High-Temperature Brazing Filler Metals.	<i>By D. C. Herrschaft</i>	89
Alloys that melt at 1750 F and higher have been developed for rockets and missiles. Suitable brazing methods are illustrated.		
Putting Learning Curves to Work.	<i>By Lou Wertman</i>	99
Knowledge of operator learning curves makes it possible to predict manpower requirements and to develop accurate cost estimates.		
Control Charts—Key to Efficiency	<i>By James H. Greene</i>	103
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How to Calibrate Small Surface Plates.	<i>By R. J. Rahn</i>	111
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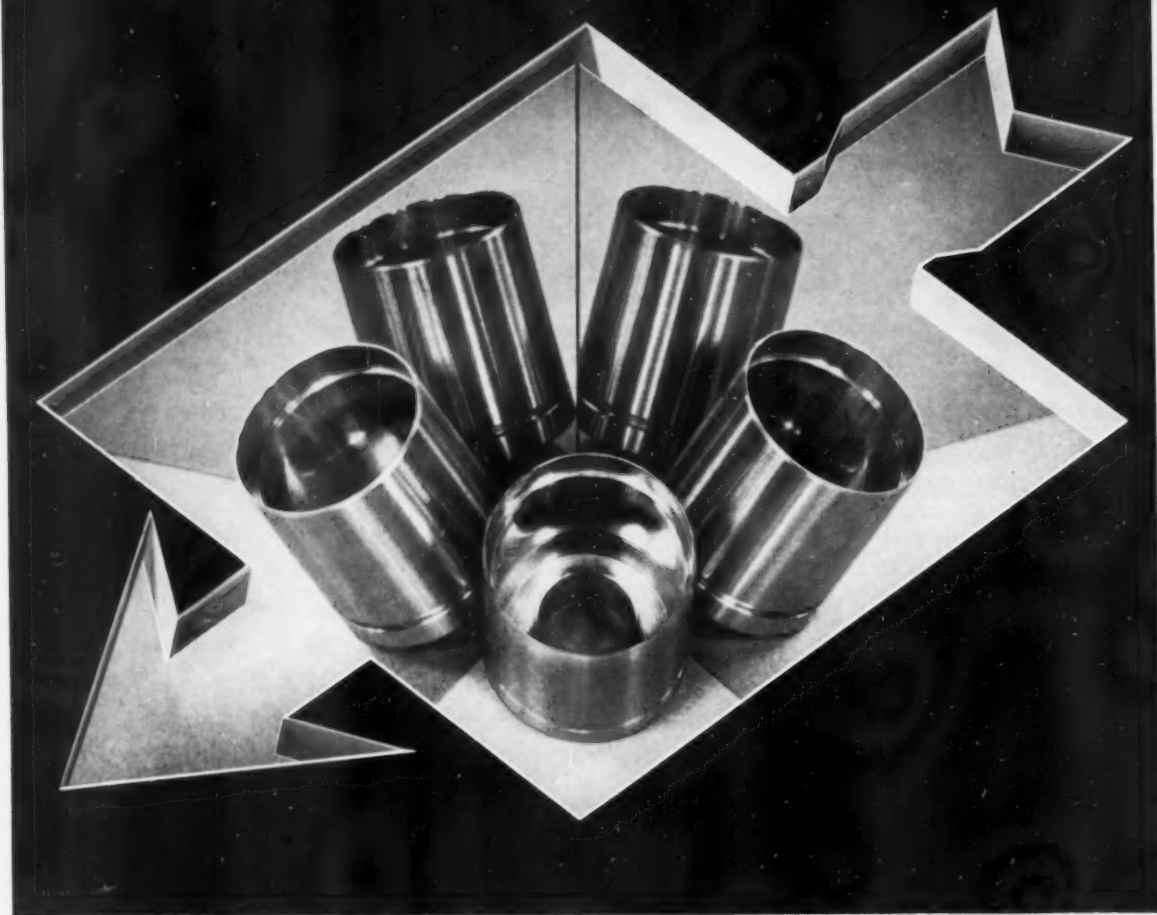
THIS MONTH'S COVER

High-temperature brazing filler materials are being used to join this honeycomb structure for a high-performance aircraft. Graphite fixtures, shaped to fit the part contour, hold the sandwich components together and prevent distortion. Such operations are often performed in special gas atmospheres or in high vacuum to eliminate corrosion. Details are given in the article starting on page 89.



THE TOOL ENGINEER is regularly indexed in the *Engineering Index Service* and *Applied Science & Technology Index*.

Quality . . . the best economy of all



Electronic parts courtesy Judson Mfg. Co., Inc., Cornwells Heights, Pa.

Mirror-bright without polishing, after switch to Sunicut

Boring on a multiple-spindle automatic produced the finish you see on these electronic parts. Sunicut 102-S Cutting Oil saved time and money by eliminating the polishing operation. The same automatic uses Sunicut 102-S to machine metals ranging from titanium to stainless 410.

Sunicut 102-S is one of a full line of cutting oils known throughout metalworking for maintaining

long tool life, close tolerances, and fine finishes. There's a grade of Sunicut that can help you improve your product quality—and *that's* the best economy of all.

To choose the right Sunicut, ask the Sun man; that's part of his service to you. Or write to SUN OIL COMPANY, Dept. TE-9 Philadelphia 3, Pa. In Canada: Sun Oil Company Limited, Toronto and Montreal.



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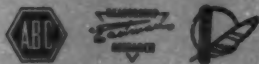
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Creative Manufacturing is TOOL ENGINEERING

Tool engineers are as concerned with removing the drudgery from engineering as they are with eliminating tedious tasks from production operations. Time-consuming chores will be minimized in the future by calculators which will solve any mathematical problem or develop the best design for tooling to do the job at hand.

This will allow the engineer to devote more creative time to improving production methods and to developing machines for making better parts at lower costs. Building block machine tools will have standardized components. Beds, ways and bases will be sectionalized and purchased by the foot to make any desirable combination of special or transfer machine.

Also, the engineer will have time to develop truly automatic assembly and inspection machines. A customer's order, probably in the form of a punched card, will be used for assembly and test instructions. There will be no chance for human error like that involved in mounting an open-frame motor when the customer specifically specified a totally enclosed drive.

Because chips produced by machining have no utility, research to minimize their formation will continue at an accelerated pace. Methods will be developed to shape, form, extrude, cast, bulge and coax the super alloys into desired intricate shapes without the intermediate creation of chips. Vacuums, scavengers, gases, magnetic fields, etc., will serve as catalysts in the production of the desired ultimate shape.

Practices today will be archaic tomorrow. New methods undreamed of heretofore will expand our economy and raise our standard of living. This will be achieved without question because creative manufacturing is tool engineering.

John W. Greve

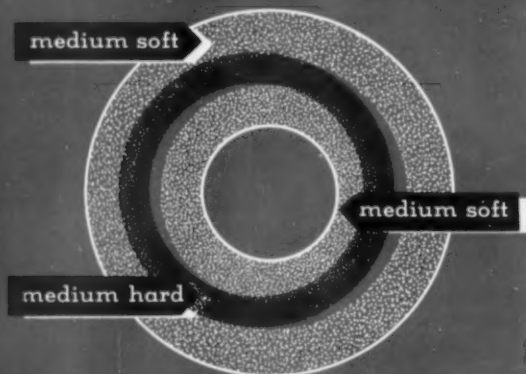
EDITOR



Disc with heat resistant BK bond increases production 70%

Grinds over 70,000 washing machine gear cases per disc

Three-grade disc with heat resistant BK bond retains flatness, needs fewer dressings



grinding costs cut 1/3 to 1/2

- longer disc life
- elimination of work burn and warping
- fewer dressings—higher output

GARDNER
abrasive discs
BELOIT, WISCONSIN

HARDINGE
ELMIRA, N.Y.

STANDARD EQUIPMENT

in

Progressive Screw Machine Plants

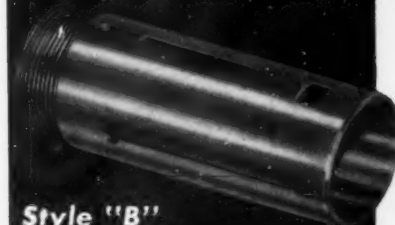
The Only MASTER COLLET
With No Work Pressure on the Screw.



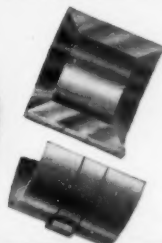
Style "S"
Master Collets and Pads



Pads Interchangeable
Among Different
Makes of Automatics



Style "B"
Master Feed Fingers and Pads

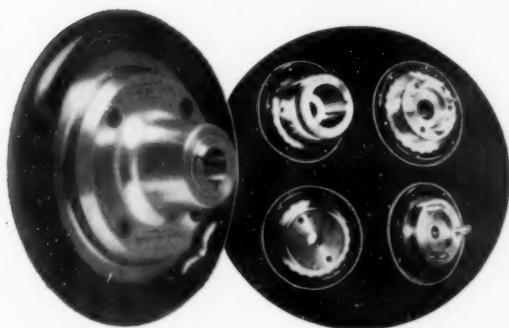


HARDINGE BROTHERS, INC., Elmira, N. Y.

Write for Style "S" Bulletin Style "B" Bulletin

HARDINGE-SJOGREN Speed COLLET CHUCKS

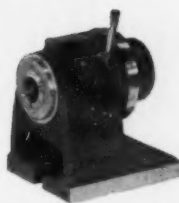
Fast — Accurate
Increase Production Capacity



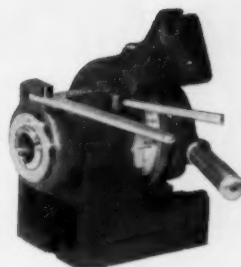
Available in $1\frac{1}{8}$ " ; $1\frac{3}{8}$ " ; $2\frac{1}{4}$ " ; and $3\frac{1}{2}$ " collet capacity.
Threaded nose, cam lock, tapered key-drive and American
Standard spindles. Write for Bulletin 8A.

HARDINGE BROTHERS, INC., Elmira, N. Y.

Immediate stock delivery from Atlanta, Boston, Chicago, Dayton, Detroit, Elmira, Hartford, Los Angeles, Minneapolis, New York, Oakland, Philadelphia, San Francisco, St. Louis.



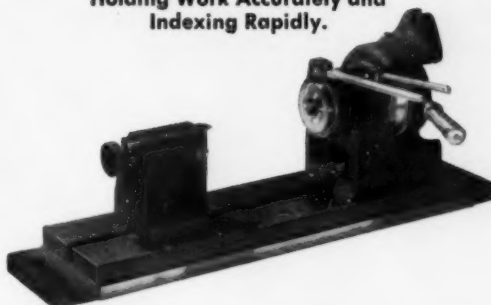
H-4 Tool Room-Inspection



HV-4 Production

HARDINGE COLLET INDEX FIXTURES

Increase Production by
Holding Work Accurately and
Indexing Rapidly.



HARDINGE BROTHERS, INC., Elmira, N. Y.

Write for Bulletin CF5

HARDINGE
ELMIRA, N.Y.

COLLETS for LATHES and MILLERS



ACCURACY — DURABILITY — LOW COST



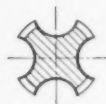
Write for Bulletin 56 —
Complete collet ordering



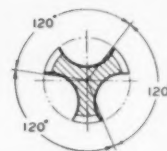
information for all Lathes, Millers, Grinders and Fixtures

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BALANCED ACTION TAPS KEEP ECONOMY AND EFFICIENCY IN PERFECT BALANCE, TOO!



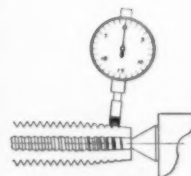
UNIFORM FLUTE CONTOURS



EXACT FLUTE SPACING



PRECISION CHIP
DRIVER CONTOURS



ACCURATE AND
CONCENTRIC CHAMFERS

Users of taps know that the cost-per-hole is the best indication of overall tool economy.

Balanced Action Taps by Winter assure you more economy through consistently uniform performance.

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Rochester, Michigan, U.S.A.

Distributors in principal cities. Branches in New York • Detroit • Chicago • Dallas
San Francisco • Los Angeles • Division of National Twist Drill & Tool Co.

*of interest
to you...?*

Should you wish to receive the recent "Winter Tapping Data" booklet, just write us. Please give your company name and title.

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for standard and special
WINTER Balanced Action
Taps, Dies, and Gages.



COSTS versus VALUES



National



Even the lowest priced tool is no bargain if it produces poor work, requires frequent set-ups, wears rapidly and needs much resharping.

National "Research Improved" cutting tools are your assurance of peak cutting efficiency at less overall costs than the so-called low-priced tools. This is the measure of true value.

National Service, Research, and Experience are the most valuable combination you can buy in tools today.

**NATIONAL TWIST DRILL
AND TOOL COMPANY**
Rochester, Michigan, U.S.A.

Distributors in principal cities. Branches in
New York • Detroit • Chicago • Dallas
San Francisco • Los Angeles



CALL YOUR DISTRIBUTOR
for NATIONAL twist drills,
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milling cutters, end mills, hobs,
carbide and special tools.

*of interest
to you...?*

Should you wish to receive the recent booklet "Hints and Aids to Efficient Metal Cutting", just write us. Please give your company name and title.

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double value

from "DOUBLE LO-HUNG" SPINDLE DRIVE...

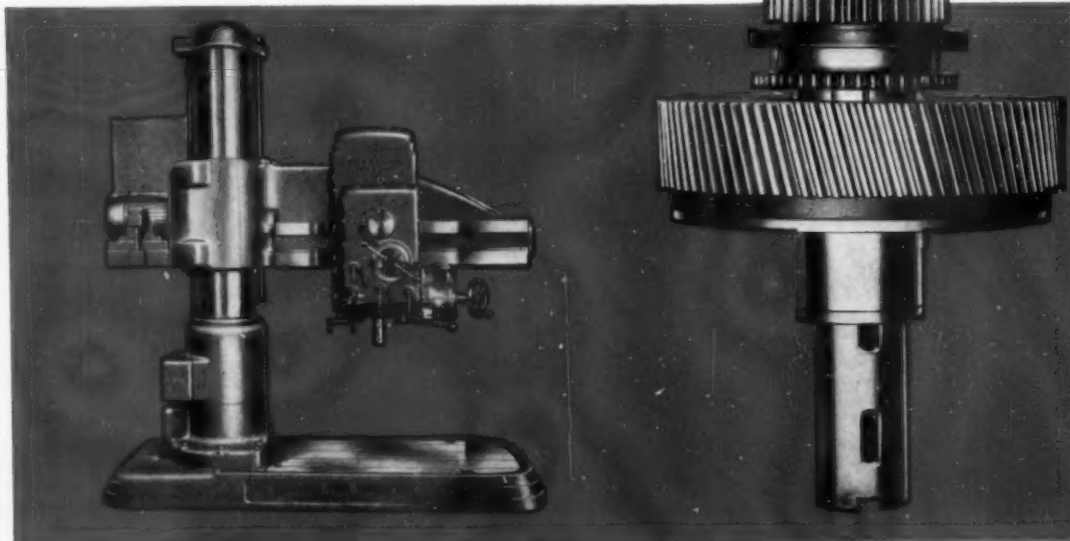
"AMERICAN"

Hole Wizards Provide:

1. *High spindle speeds at low gear velocities.*
2. *Heavy drilling, boring and large tapping speeds at low tooth pressures.*
3. *Faster tapping through spindle reverse speed-up.*

The "Double Lo-Hung" Spindle Drive is an exclusive "AMERICAN" Hole Wizard feature. This drive divides the speed range into two separate ranges; the high speeds through a small gear to minimize gear velocities; the low speeds through a large gear to reduce gear tooth pressures under severe service.

This design in combination with its nitrided Spindle and Sleeve, Timken Mounted with outside adjustment for Spindle Bearings, guarantees maximum life, dependable operation and spindle stability for "AMERICAN" Hole Wizards unequalled by other designs.



• Bulletin No. 328 tells the story

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

The Tool Engineer

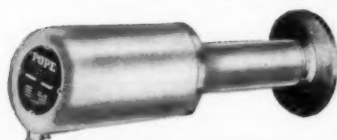
POPE engineers and builds 20,000

DIFFERENT motorized and Belt Driven

SPINDLES

one of which may be just the one to
LOWER YOUR PRODUCTION COST

Here are only a few representative Pope Precision Spindles:



FOR SURFACE GRINDING

POPE 1, 2 and 3 HP Totally Enclosed 1800 and 3600 RPM Motorized, Cartridge Type Spindles with double row cylindrical roller bearings of enormous capacity for superior performance and long life, plus separate thrust bearings for no endwise movement of the shaft.

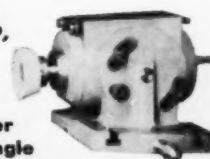


FOR HEAVY DUTY MILLING AND GRINDING

POPE $\frac{1}{4}$ to 100HP Direct Motorized Spindles operate in any position — flanged or tapered noses — equipped with super-precision, double-row roller bearings and preloaded ball thrust bearings. Top quality performance is assured on skin milling, grinding, boring and other operations as well as milling.

FOR TOOL AND CUTTER GRINDING

POPE Super-Precision 1 HP, 3600 RPM Motorized Tool and Cutter Grinder



Clearance Angle Swivelling Heads provide angular adjustment in a vertical plane. They pay for themselves in time saved. Cup wheels can be used for practically all clearance angles.



FOR BORING ROUND HOLES WITHIN MILLIONTHS OF AN INCH

POPE Heavy Duty Boring Spindles assure smooth, chatter free, continuous high production of accurate parts. Belt driven or motorized, in a wide range of horsepower and speeds.



FOR INTERNAL GRINDING

POPE Precision Internal Grinding Spindles have the super-precision bearings to withstand both axial and radial loads and to produce better finished ground holes. Their ability to take heavy cuts means increased production. Wheel life is increased, too. For Bryant, Cincinnati, Exello, Heald, Landis and Norton Grinders.

FOR HIGH CYCLE GRINDING AND MILLING

POPE Super-Precision, High Frequency, Heavy Duty Spindles are available for speeds up to 100,000 RPM.



They are unequalled for low cost maintenance, long life, trouble-free operation and rugged ability to cut metal fast.

Send us your specifications and get prompt quotations on the one best Spindle for you out of the 20,000 different Precision Spindles that bear the name "POPE."

No. 116

POPE®

**ENGINEERS AND BUILDS STANDARD AND SPECIAL
PRECISION ANTI-FRICTION BEARING SPINDLES
FOR EVERY PURPOSE**

POPE MACHINERY CORPORATION • 261 RIVER STREET • HAVERHILL, MASS.

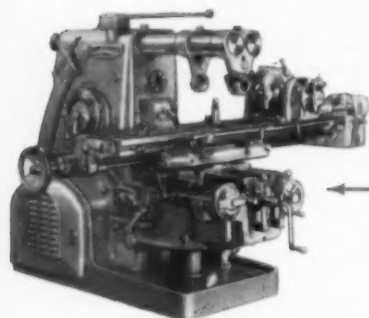
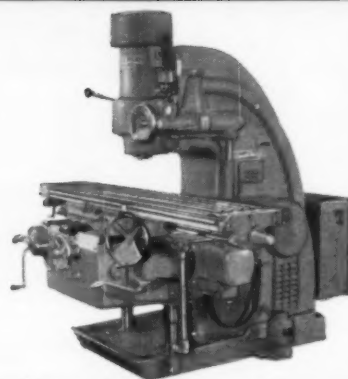
Established 1920

Kearney & Trecker machine tools quality...greater economy and



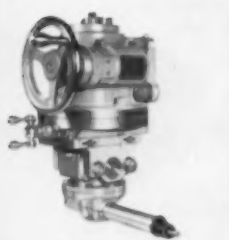
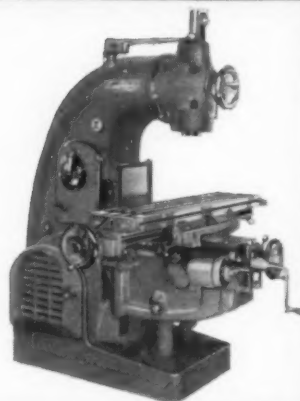
TF Series Line

Strikingly new milling machines feature twin screw knee support for greater rigidity; new control center for ease of operation; improved Mono-Lever and Automatic Cycle Table Control; front-mounted backlash eliminator; adjustable saddle clamping gib; three bearing spindle that increases rigidity eight times over spindles without center bearing support, and many other features. TF's are available in five sizes Plain (left), Universal and Vertical (right) styles from 10hp to 50hp. (Catalog No. TF-50)



CH & CHL Milling Machines

These modern knee type milling machines incorporate the latest design and operating features...greater capacity for power, speeds and feeds. Machines are available in Plain, Universal and Vertical styles... 3 to 10hp. (Catalog No. CH-3)



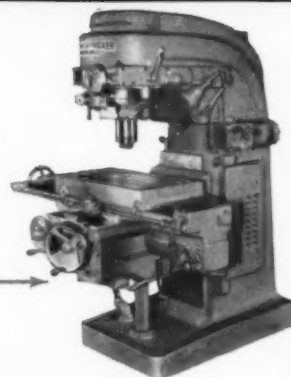
Attachments and Accessories

A complete selection for every milling requirement to convert standard machines into special purpose tools. Provide maximum productivity by supplementing with any of the various Kearney & Trecker standard attachments. Bulletins available on request.



Model 2D Rotary Head

Rotary head motion, combined with milling machine's ability to do boring, slotting, drilling, vertical milling, circular and angular milling, transmits complete blueprint into metal without changing setup. Speed range 250 to 4000 rpm; feed range .0002 to .008 ipr; rotary head feed range (16 changes) 2 to 3 rpm. (Catalog No. D-20)



TOOL-LEASE

Should you desire, you can conserve capital, reduce obsolescence using Kearney & Trecker's Tool Lease program. You can choose the machines you need from nearly 350 different standard milling and precision boring machines.

Designers and Builders of Precision and Production

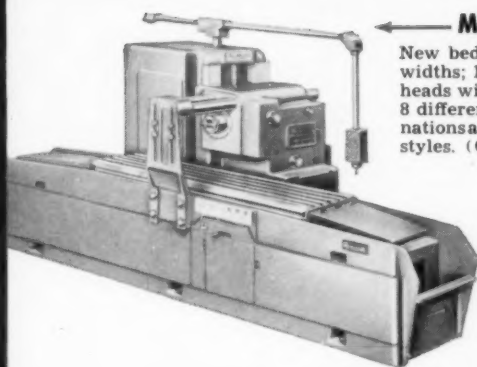
offer you more productivity and performance than ever before...

TODAY, Kearney & Trecker gives you several complete new lines of knee and bed type milling machines, precision boring machines and special production machines to meet growing metalworking needs.

Note the *exclusive* twin-screw support of the massive knee and saddle on the new TF Series milling machines... the compact,

central control grouping... profit-making features typical of the advanced design you'll find on every machine shown.

For complete information on these new machines, see our nearest representative. Ask for catalogs listed here, or write Dept. TE-99, Kearney & Trecker Corp., Milwaukee 14, Wis.

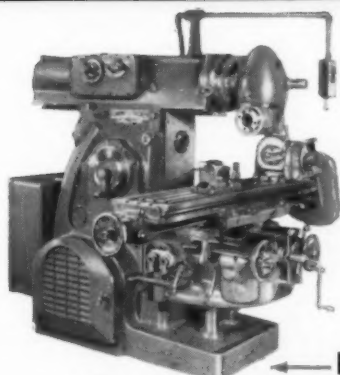
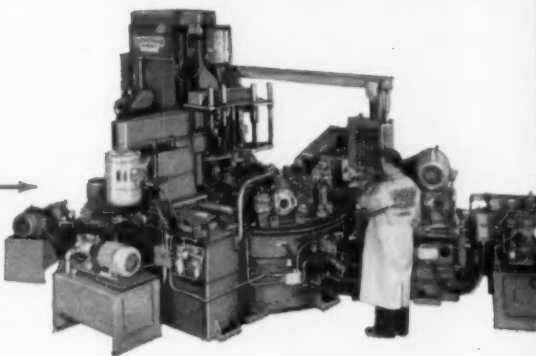


Mil-waukee-Mil Series

New bed-type design features: 4 table widths; 12 table sizes; 3 sizes of spindle heads with 3 speed ranges in each size; 8 different hp ratings. Over 300 combinations available in Simplex and Duplex styles. (Catalog No. MM-55)

Special Rotary Indexing and Transfer Machines

This 5-station rotary indexing machine features standard units: feed slides, quill feed, drill power units and rotary index table. Other special machines available. (Catalog No. SMD-10 and Data Sheet 1076)

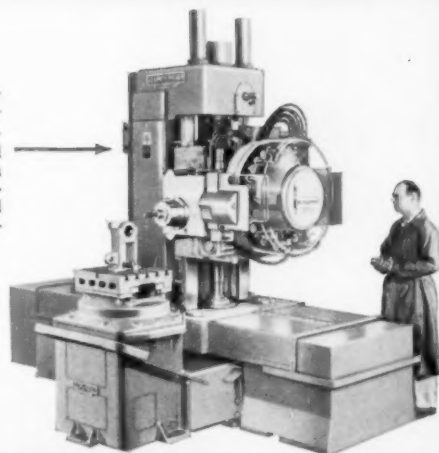


Ram Head Milling Machines

Machine combines standard horizontal spindle with separate motor-driven vertical spindle mounted on sliding Ram. Ram may be equipped with either Universal, Vertical or Quill type head. Machines available in No. 2 to No. 4 sizes, Plain and Universal styles (Catalog No. RH-10)

Numerically controlled MILWAUKEE-MATIC

This single unit, tape-controlled machining center, unifies three basic processes — milling, drilling and boring. It is flexible automation of simple and complex machining operations on small- and medium-size lot production. Thirty-one tools are changed automatically on this new tape-controlled production machine. (Catalog No. TG-58)



Machine Tools Since 1898

USE READER SERVICE CARD, CIRCLE 8



electro→probe.

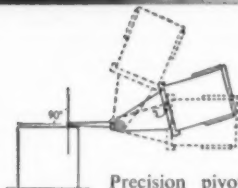


Yes, the Electro-Probe does measure to high accuracies, even with a set-up as limber as this. It's the only gage that can!

1

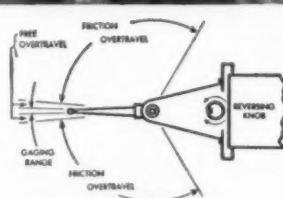
By far the lowest contact pressure of any electronic gage... only 2.5 grams... a precision touch so light that you can gage *dependably, in the shop* without the need for highly rigid, heavy-weight stands. Only with the Electro-Probe do you get high accuracy gaging using an ordinary test set or other *easily* available fixture.

2



Precision pivot design keeps this feather-light pressure virtually constant throughout range to maintain necessary gaging accuracy (change is less than 0.1 gram per .001" of contact travel). This pressure uniformity is found only in the Electro-Probe. AND only in the Electro-Probe is this pivot point properly located so that magnification *remains constant* with changes in gage head position.

3



You can use the Electro-Probe anywhere safely and conveniently. Gage head and cord are impervious to oil and water. Contact can be positioned anywhere within arc of over 200° and is clutch-mounted for complete overtravel protection. Small ball tip on contact lets you check where other electronic gages cannot. Other size tips available.

Ask **FEDERAL** First

FOR RECOMMENDATIONS IN MODERN GAGES . . .

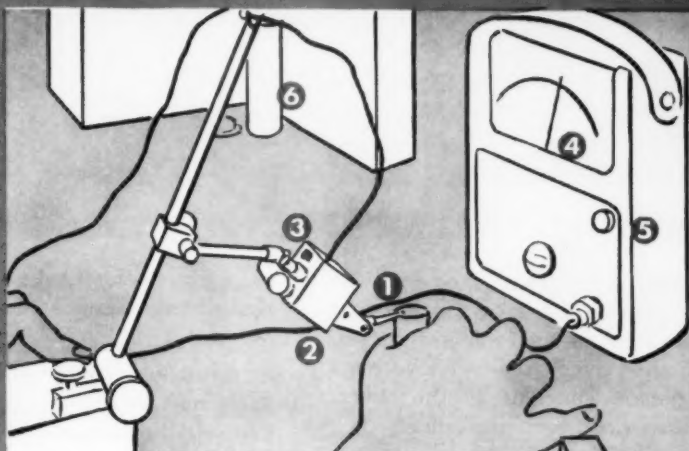
Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

the original and still by far the best low cost, portable, electronic gaging unit

ITS

Leather light

TOUCH MAKES THE **BIG** DIFFERENCE



4 Wide view dial has accurately calibrated, clearly marked scales. Pointer is needle thin for precise, unconfused readings. You choose any two magnifications you want from 100 X to 10,000 X. Lowest magnification gives you $\pm .020"$ range and $.001"$ min. grad.; highest gives $\pm .0002"$ range, $.000010"$ min. grad. Lightweight amplifier uses high-reliability transistors that outlive vacuum tubes 20 or 30 to 1. Mercury cell batteries provide long life, constant voltage, drift-free operation; give you an *electronic* gage which has *instant* start up. No slow-charge batteries and dangling AC cords to impair its use and portability.

5 Wide range electrical zero adjustment lets you set-up quickly, without the need for close, time-consuming mechanical adjustment of the gage head. For convenience, zero settings and readings coincide on both scales. Printed wiring is rugged and mounted on extra-thick, heavy duty card to give you lifetime dependability.

6 The Electro-Probe is truly a gaging UNIT — comes equipped with holding bars and rods, plus swivel clamp and variety of backs — all you need for mounting the head on available test-set stands and similar fixtures. The gage head, self-powered amplifier and accessories are packaged for portability in one lightweight metal carrying case . . . and the Electro-Probe has the lowest price tag of any comparable instrument, even those that provide only a gage head and amplifier!

Want a demonstration? . . . gladly, at your convenience.

Brochure available, write . . . **FEDERAL PRODUCTS CORP.**
9199 Eddy Street, Providence 1, R. I.



COILED WIRE +

SIMPLE TOOLING



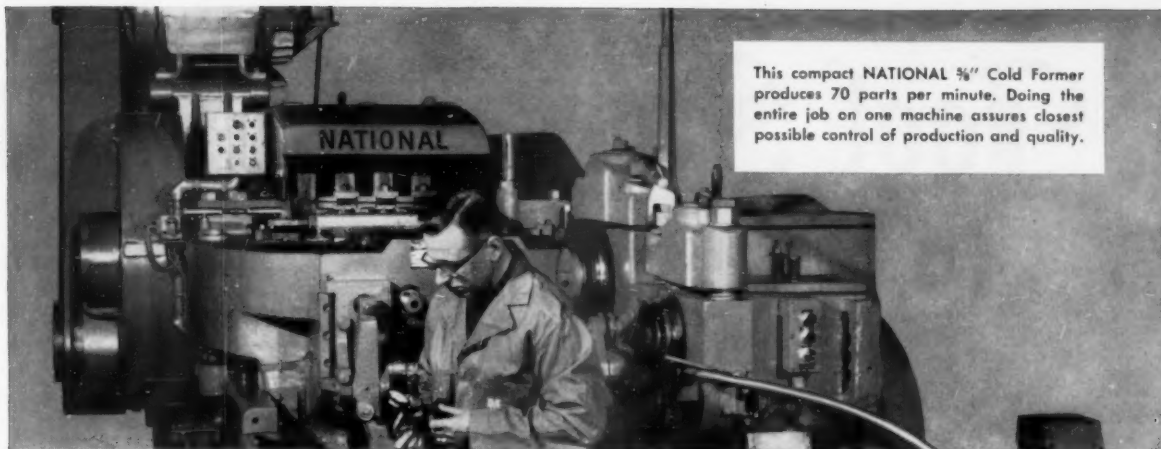
In cold-forming hollow parts from wire, the extrusion punch is the most critical and perishable element of the tooling. And yet, the typical steel punch shown above costs only a few dollars. Punch life for the universal joint bearing cup part is excellent.

Part "X" (name and illustration withheld at customer's request) is a deeper extrusion of higher-carbon material. Punch life for this practically-finished part is also remarkable

even though the blanks — cut off from wire right in the Former — *are not end-coated!*

These are two more important cold-extruded jobs which forward-looking U. S. parts makers are now producing — automatically and successfully from coiled wire — on NATIONAL Cold Formers. No slugs to prepare, no in-between heat-treating or annealing, less handling, and many fewer operations.

PART	UNIVERSAL JOINT BEARING CUP	PART "X"
MATERIAL	C-1008 Drawn Coiled Wire	C-1016 Drawn Coiled Wire
MACHINE	3/4" NATIONAL Cold Former	1/2" NATIONAL Cold Former
PARTS PER MINUTE	60	80
EXTRUSION DIE LIFE	Practically Unlimited	Practically Unlimited
IS PART IN PRODUCTION?	Yes, at Pottstown Div. Dana Corp., Pottstown, Pa.	Yes, plant name and location withheld by request



+ COLD FORMER = LOW COST PARTS!



WHAT IS THE BEST WAY TO DO AUTOMATIC COLD FORMING?

ANSWER: Produce from wire! Cold Formers and Progressive Headers are built upon our conventional Cold Nut Former and Boltmaker designs.

Is Material Expensive?

No. Coiled wire is low-cost material. (Of course, none is wasted by forming).

How Long Do Other Tooling Items Last?

Using bearing cup job as an example: Cutter and quill, hundreds of thousands of parts each; carbide die life is measured "by the millions."

What Preparation Does Coiled Wire Need?

None. You buy inexpensive drawn wire, ready to start into the Former.

How Do You Get the Initial Blank?

The Former cuts off accurately, and automatically transfers the blank from station to station until finished.

Do Physical Properties Measure Up?

They are excellent. Cold Forming actually improves them.

What About Labor and Floor Space?

Materially reduced. Verify by comparing Cold Forming with your present methods.

What Are the Biggest Advantages?

With the NATIONAL Cold Former you produce parts complete from coiled wire. You eliminate many operations and related handling problems. Result? More quality parts at lower production cost!

Can Your Jobs Be Made More Profitably by Automatic Cold Forming?

We Welcome You to Tiffin for a Discussion of Your Work

Founded 1874—DESIGNERS and BUILDERS of MODERN FORGING MACHINES • MAXIPRESSES • REDUCEROLLS • COLD HEADERS • BOLTMAKERS • NUT FORMERS • TAPPERS • NAILMAKERS • CO-PIONEERS WITH INDUSTRY OF ADVANCED METALWORKING PRODUCTION METHODS

NATIONAL MACHINERY CO.

TIFFIN, OHIO, U. S. A.

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September 1959

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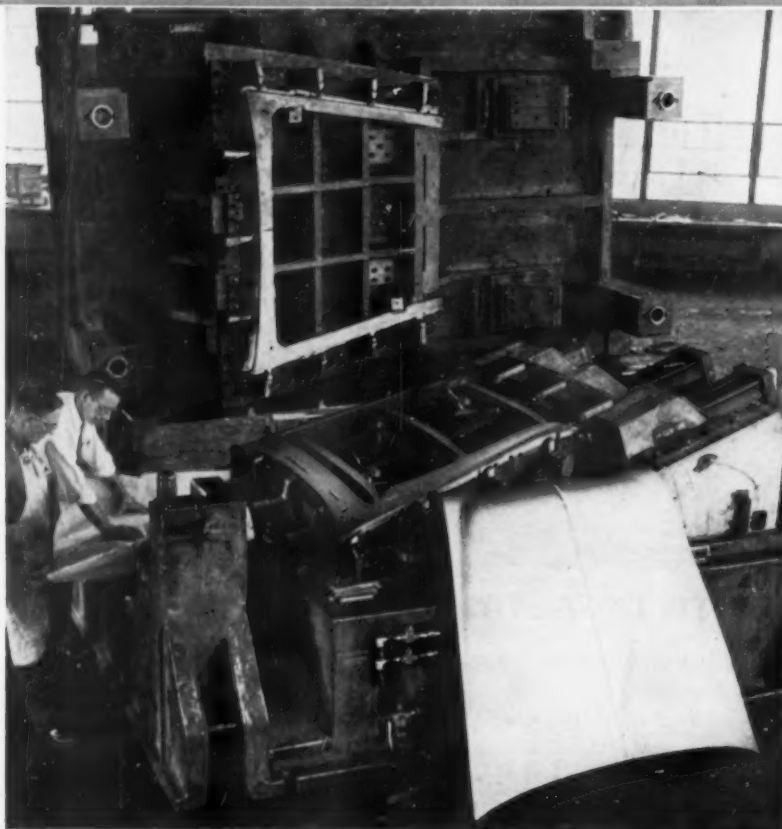
15



Tool Steel Topics



BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation



Automotive Die, in 101 Sections, Made from Water-Hardening Steel

This huge die, made up of Bethlehem W-1 carbon water-hardening tool steel, trims an automobile hood. Made from tool steel furnished by Peninsular Steel Co., Detroit, the die was photographed recently at Republic Die & Tool Company, Wayne, Mich. It contains 44 composite sections, 34 wear plates, and 23 solid sections.

Bethlehem carbon water-hardening steels were selected for this exacting application because of their good wear-resistance, easy machinability, and simple heat-treatment—plus ease of welding should repair become necessary.

Bethlehem carbon water-hardening tool steels, because of their carefully controlled hardenability, provide economical service in applications calling for high shock-resistance. And with their highly selective carbon range, they have good resistance to wear, plus the toughness to withstand cold battering.

If you have any questions about the use of Bethlehem carbon water-hardening tool steel, or any of our other popular grades, get in touch with your Bethlehem tool steel distributor. He's as near as your telephone.

BETHLEHEM TOOL STEEL ENGINEER SAYS:



*Here's How to
Stabilize Gages*

High-precision gages, commonly made of BTR tool steel (AISI Type 01), need a stabilization treatment if they are to maintain their accuracy for years. Otherwise expansion will eventually change dimensions outside of the permissible tolerance. These dimensional changes are in a magnitude of hundred-thousandths of an inch per inch, or smaller. Insignificant on ordinary tooling, they are important on precision gages.

The expansion which occurs over a period of time is due to the transformation of austenite retained during the quench for hardening. The object of the stabilization treatments is to transform the retained austenite during the treatment, so that none remains which could transform later on. This condition exists in all tool steel grades which can be hardened to Rockwell C 60 or higher.

The most common method for stabilizing high-precision BTR gages is:

1. Quench and temper in the normal manner to produce the desired hardness.
2. Rough grind.
3. Subzero cool to minus 100/120 F in refrigerator or dry ice.
4. Warm to room temperature and then retemper at original temperature.
5. Finish grind to size.
6. Repeat cycles of subzero cool followed by tempering five more times.
7. Lap or superfinish to size.

Sometimes it is possible to shorten this procedure, particularly if the design is such that there is little hazard of cracking. For example, the tools can be subzero cooled directly from the quench, with no interval at room temperature, followed by tempering and grinding. This will permit stabilization with only two additional cycles of subzero cool plus temper, but the disadvantage is that cracking may occur after quenching.

It is also possible to shorten the stabilization by cooling to minus 314 F in liquid air. This permits reducing the cycles of subzero cool plus temper to three instead of six.

BUSHINGS...



on the Rocks!

It's "refreshing" to know — American provides drill jig bushings for every tooling purpose. We serve them to your "taste", to satisfy your job requirements. This is an *American* tradition.

Your local exclusive American distributor can fill your order for practically any size or type of bushing, right from his shelf. *You can depend on American* for precision drill jig bushings, engineered to fit your needs precisely.

Write for FREE Catalog. Its easy selection tables make ordering the correct bushing a snap.

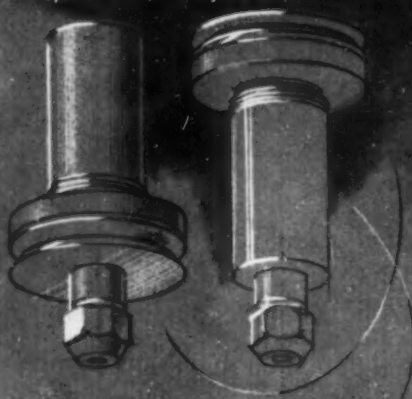
American

DRILL BUSHING CO. • 5107 Pacific Blvd. • Los Angeles 58, Calif.

Every Whitnon milling spindle comes with something extra

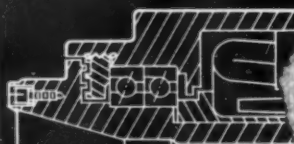
Close tolerances, precision bearings, the right preload, perfect balance . . . all these go into every Whitnon spindle, along with something extra; our proud determination that every spindle labeled Whitnon will be the best of its type. Catalog # 59 is available now. Ask for it.

Whitnon special engraver spindle with pulley at either end, to best suit the clearance and vision requirements of work. Speeds to 28,000. Style B-176.



3 TO 10 HP

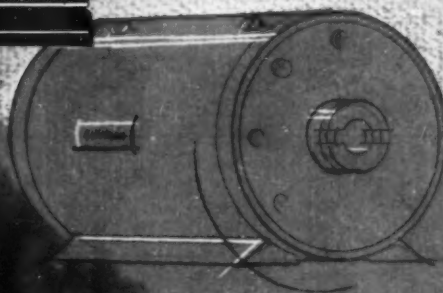
Motorized Whitnon spindle with the extra power needed for milling ferrous or non-ferrous materials. Check series D-188.



Efficient labyrinth seals
Large precision bearings
Efficient lubrication
Proper preload

Extra-heavy-duty motorized milling spindles in a range of speeds and motor types to handle the tough jobs best. See Whitnon series D-321.

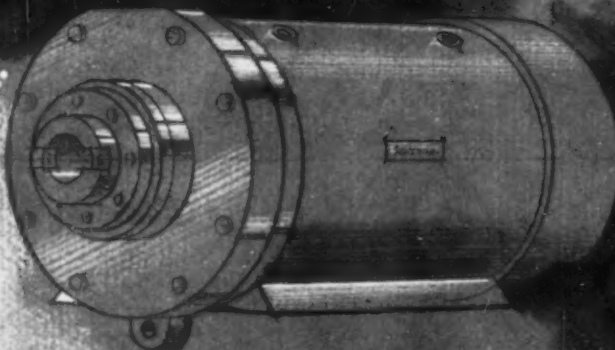
10 TO 50 HP



Specialists in the design and manufacture of precision spindles. Custom builders of precision rotary machinery for use in computer drums, plywood routers, glass fiber and synthetic fiber processing systems. Expert spindle repairs at Farmington and at Whitnon Spindle Co., 20466 Wyoming Avenue, Detroit 21, Michigan

Brute force skin milling spindles with all the usual Whitnon accuracy, and speeds to 12,000 rpm. Investigate series E-100.

50 TO 200 HP



Whitnon

The Whitnon Manufacturing Company

Route 6 and New Britain Avenue . . . ORchard 7-2607
Farmington, Connecticut

DIESEL ENGINE MANUFACTURER CUTS HANDLING 50%,

PRODUCTION POINTERS

from

GISHOLT

More
cost-cutting
IDEAS—
to help
you

HOW BARBER-COLMAN ELIMINATES "GUESSWORK" ON MACHINE REPLACEMENT

Two-point program determines need, turns future losses into profits

With careful planning, as shown here, it is easy to discover profit leaks in old equipment before they become serious losses. Substantial savings and earnings result when replacement is timed right.

The 2-point program used by Barber-Colman Company, Rockford, Illinois, is a modification of the MAPI Formula. It pinpoints the most opportune time for action and verifies the purchase decision on actual work.

Here's how this plan works: Barber-Colman made a detailed study comparing a new Gisholt No. 5 Ram Type Turret Lathe and an old turret lathe on the basis of the coming year's work. Production rates and operating, maintenance and depreciation costs for each machine were analyzed on the Barber-Colman Standard Replacement Analysis Form.

These costs (including renovating) for the old machine indicated that immediate replacement with a new No. 5 would effect substantial savings in costs during the first year alone. The new Gisholt offered greater swing for a wider work range. Greater horsepower, higher speeds and a wider feed range would permit more efficient use of carbide, ceramic and cemented oxide tools.

Four months after purchase, a careful on-the-job analysis showed that the new Gisholt saved an average of 38% in production time on all parts.

Here's how this versatile Gisholt No. 5 allowed a 58% saving on a typical problem part—a 3-pound, 9" aluminum brake arm for a Barber-Colman textile machine. A face-plate fixture is used for locating, holding and driving. Drilling, forming multiple-face diameters, boring and reaming are handled from the hex turret. A single tool on the cross-slide square turret faces the boss at the end. Total

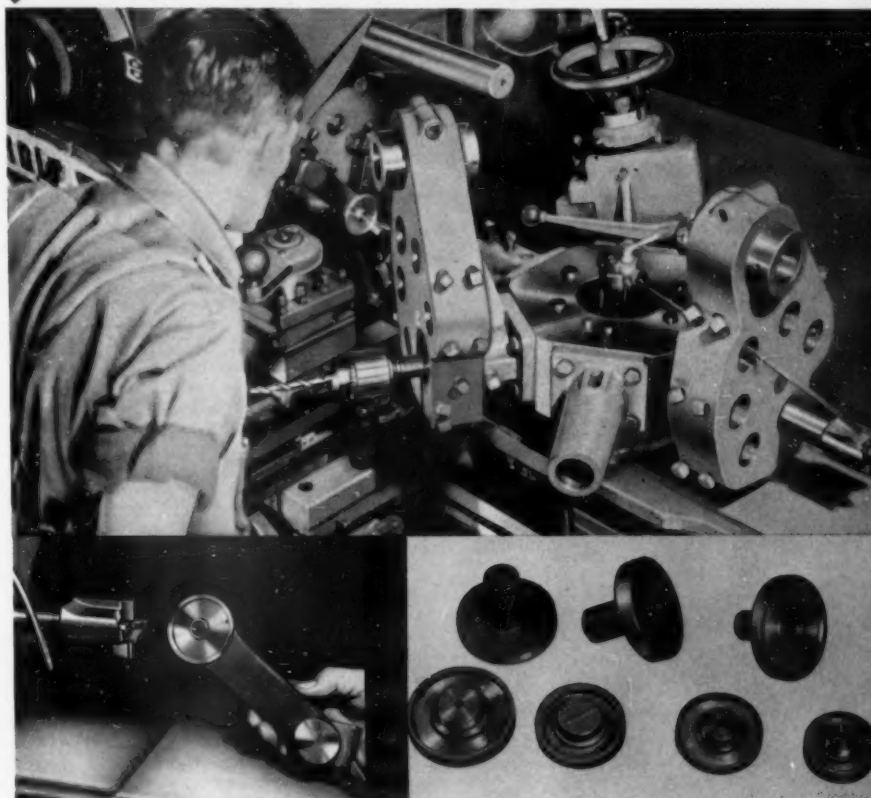
f.t.f. time is 5.7 minutes as compared with 14.1 minutes on the old machine.

A few of the many parts handled in like manner with similar savings are shown at bottom. Change-over is fast and easy. The standard multiple and flanged toolholders remain in position on the hex turret. Only the standard boring bars, toolholders, stops,

etc., are replaced or reset. The fine surface finishes obtained despite multiple-form cutting in a single pass speak for the rigidity and power of the Gisholt No. 5.

Sound program pinpoints timely replacement. Time saved averages 38%.

A typical example of the simple tooling allowed by the Gisholt MASTERLINE No. 5 Ram Type Turret Lathe. Many different parts are machined with the same basic setup. Production time on all parts averages 38% faster than obtained with the old machine.



For complete facts on No. 5 Ram write in No. 1749 on inquiry card.



The new Gisholt No. 5 machines this 3-pound cast aluminum brake arm 58% faster than the old machine. Multiple-diameter cutter completes face diameters in one pass for greater accuracy.

Typical workpieces. Top row: Rack and pinion gear blanks. Bottom: Brass disc holder valve assemblies. Fine surface finish on multiple-diameter faces obtained in a single pass demonstrates machine rigidity.

LEYLAND MOTORS LTD. SAYS.





DIESEL ENGINE MANUFACTURER CUTS HANDLING 50%, MACHINING 30% ON FLYWHEELS

**No. 24 with loader
and back-boring
attachment speeds
work and improves
accuracy**

In high-production machining, even a few seconds saved per piece spell the difference between profit and loss. This setup gives you ideas on reducing handling and machining time, using single-spindle automatics.

The machine is a Gisholt MASTER-LINE No. 24 Automatic Chucking Lathe. Over 75 different sizes of cast iron flywheels are handled in lots of five to 100 pieces. Diameters range from 13" to 24", widths from 2" to 6".

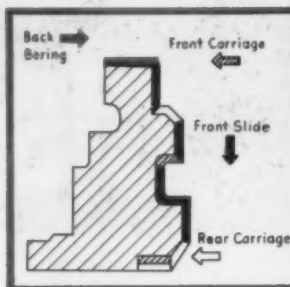
Proper machine selection and smart tooling solve three problems:

Work Handling—cut 50% by a headstock-mounted swinging loader.

Accuracy—improved by a spindle-mounted back-boring attachment that combines boring with other cuts in a single chucking.

Floor Space—formerly, two machines were required. Now one No. 24 handles the entire range; provides the swing, rigidity and power to remove metal faster in 30% less time.

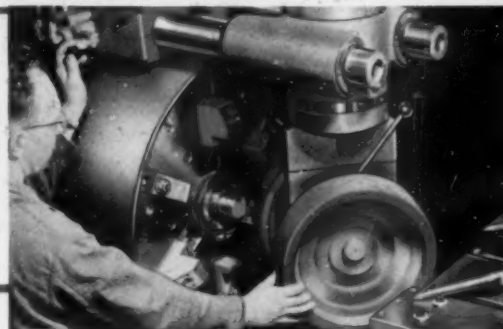
Here's how the part shown—14" diameter, 3.880" wide—is handled.



Surfaces machined in just 4.6 minutes, f.t.f. Arrows show carriage and slide movements.

While one part is being machined, another is positioned on a headstock-mounted swinging loader which has a 2-position indexing stock carrier. At cycle end, simple loader controls permit the following sequence: swing carrier parallel to machine center line; traverse in to pick up finished part; traverse out and hold while carrier is indexed 180°; traverse in and hold while new part is located and gripped in power-operated chuck; traverse out and swing carrier clear of tools. During automatic cycle the operator checks and removes the finished part and loads next workpiece.

The drawing shows the various surfaces machined. Total f.t.f. time,

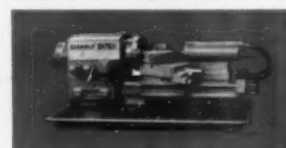


Operator indexing work carrier. Note back-boring attachment in spindle bore.

just 4.6 minutes—including only .8 minute to load, operate and unload.

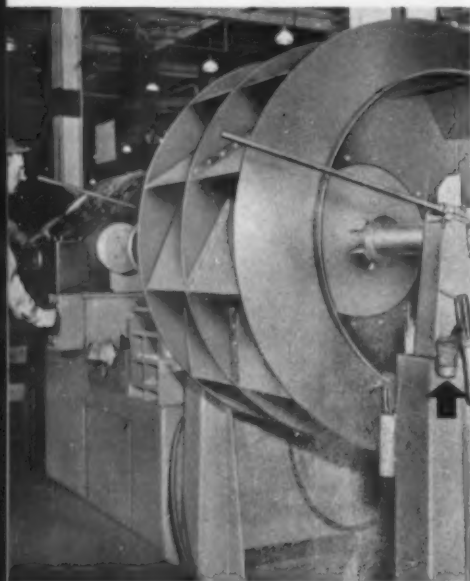
Loader cuts work-handling time .8 minute per piece. Back-boring attachment permits use of fast, rugged No. 24; cuts machining time 30%; provides greater accuracy, longer tool life, finer finish.

For complete facts on No. 24 Auto Chucking Lathe write in No. 2749 on inquiry card.



HOW TRANE CO. SAVES ON LARGE-PART JOB-LOT BALANCING

Balancing machine flexibility and fast setup trim costs



Operator, completing setup, prepares to start balancer. Arrow indicates convenient welding equipment.

Do you think of balancing in terms of long production runs? Do you consider job-lot balancing too costly to handle in your own shop? This setup shows that even single units can be balanced with greater accuracy for less than it costs to transport the work to and from a balancing subcontractor.

Accurate balancing is highly important in the operation of centrifugal fan wheels used in air-conditioning, ventilating and industrial process systems. Operating noise must be kept to a minimum and vibration must be eliminated.

The Trane Company, La Crosse, Wisconsin, not only meets those requirements but trims costs on job lots by using a Gisholt Type 6UH Balancer. Machine versatility permits handling wheels from 24" to 89" in diameter, 9 1/8" to 97 1/8" in width, 80 to 4500 pounds. Lots range from one to 75 units.

Here are the steps for balancing a single part (the 54" double-width, double-inlet fan wheel shown above):

Workpiece—insert supporting arbor. Machine—insert half bearings and adjust to work width. Load work; attach drive coupling; position angle

indicating rods; rotate; note angle and amount of unbalance in each plane; stop work; index and weld correction weights at indicated angles; rotate for inspection reading; make any final correction required; remove. F.t.f. time, just one hour and 45 minutes.

Balancing identical parts is still faster. The machine is set up on the first piece and calibrated to indicate the exact amount of material to be added or removed, in terms of the correction method used. The remaining parts can then be handled in one quick reading.

Flexible Gisholt Balancer handles wide work range at lowest unit cost. Fast setup saves time—even on 1-piece jobs.

For complete facts on "U" Balancers write in No. 3749 on inquiry card.



ASK YOUR GISHOLT REPRESENTATIVE ABOUT FACTORY-REBUILT

LEYLAND MOTORS LTD. SAYS, "SUPERFINISHED PARTS LAST LONGER"

**Superfinishing
improves quality,
extends service life
of heavy-duty
transmission parts**

Superfinish can cut your costs many ways—it eliminates or reduces grinding time and provides a finer finish for longer service life. It is flexible—can be used on cylindrical, flat, tapered, spherical or eccentric surfaces. Setup is fast and does not require highly trained personnel. Except for loading and unloading, the operator is free for other work.

The setup used by Leyland Motors Limited, Lancashire, England, may give you some ideas on how Superfinish can be used in your own operations. The machine, a Gisholt Model 51-A General-Purpose Superfinisher, handles a wide variety of transmission parts used in cars and trucks.

On the main-shaft setup (shown), 60 pieces are produced per lot. Superfinishing of a single $1\frac{1}{2}$ "-long bearing diameter removes .0002" stock.



Gisholt Model 51-A General-Purpose Superfinisher at Leyland Motors Limited, used to improve quality and lengthen service life on a wide variety of heavy-duty transmission parts. Note how parts are "banked" on racks behind and at right of operator to speed work flow.

It reduces the previously ground surface to a "controlled" 3 micro-inch RMS finish. F.t.f. time, only 2.4 minutes. Stone life on the 60 Rockwell C material is about 700 pieces.

Superfinishing costs are less, compared to the time and grinding wheel expense that would be required to finish-grind to 3 micro-inches RMS.

Wide adaptability makes the Model 51-A ideal for job lots or production runs. Savings in cost, plus increased customer satisfaction due to increased service life, justify a thorough investigation of Superfinish on all your parts.

For complete facts on 51-A Superfinisher write in No. 4749 on inquiry card.

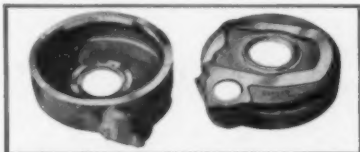
HERCULES MOTORS SAVES 43% WITH AUTOMATICS ON JOB LOTS

Fast chucking on versatile Simplimatic is key time-saver

If you produce a variety of parts in small lots, similar in design but varying in dimension, automatics will cut your costs.

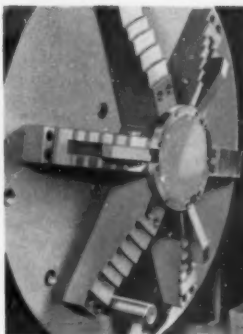
For example, check this setup at Hercules Motors, Canton, Ohio. The first three operations on 11 different sizes of cast iron industrial engine gear housings were being handled on 6 hand-operated lathes. Lots were small, 5 to 200 pieces. Bores ranged from 10" to 20". Annual production was sufficient to justify use of three automatics—if each could be equipped with a single fixture and a set of tooling developed to handle the entire work range.

These requirements were met by three gapped-bed Gisholt MASTERLINE Simplimatics, cutting machining time 43% on these parts.



Here's the sequence on the medium-sized, $14\frac{1}{4}$ "-bore housing shown.

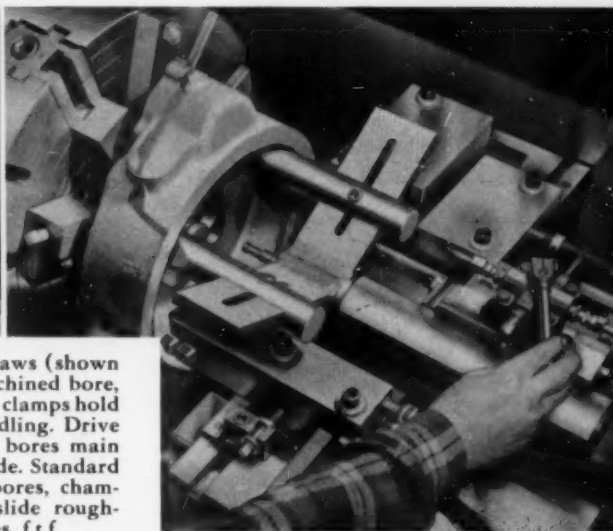
Operation 1 (setup shown at right)—Three-point loader centralizes work on spring-loaded, tapered chuck jaws, against jacks. A drawbar clamps in small bore. Drive is by a pin in starter gear hole. Open end is faced, bored and chamfered. Time, 3.80 minutes, f.t.f.



Operation 2—Stepped jaws (shown above) centralize in machined bore, locate against face. Three clamps hold and pivot for work handling. Drive is by a pin. Table feed bores main shaft hole from front slide. Standard feed straddle-faces, co-bores, chamfers and forms. Rear slide rough-faces. Time, 3.90 minutes, f.t.f.

Operation 3 (same fixture as operation 2)—Front slide tools rough-turn small hub. Rear slide tools finish $8\frac{1}{2}$ " interrupted face. Center slide tools finish-turn and chamfer small hub, finish-bore and chamfer main shaft hole. Time, 7.70 minutes, f.t.f.

Fixture and tooling, adjustable for wide work range, permit mass-production efficiency on job lots. Three automatics replace 6 hand-operated lathes, cutting time 43%.



For complete facts on Simplimatic write in No. 5749 on inquiry card.



MACHINES WITH NEW MACHINE GUARANTEE





HOW CANADIAN INGERSOLL-RAND CO., LTD., SAVES ON FIXTURING

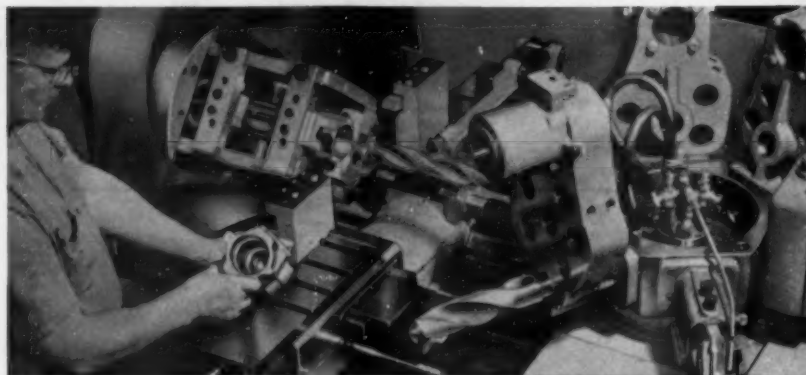
**Fastermatic handles
job lots automatically,
cuts machining time 50%,
change-over time 19%**

With the right machine—the right fixturing and tooling—your short-run fixture jobs can be handled automatically at considerable savings.

That's the story at Canadian Ingersoll-Rand Co., Ltd., Sherbrooke, Quebec, Canada. Here over 40 different parts—in lots of 40 to 110—have gone automatic on two Gisholt MASTERLINE 2F Fastermatic Automatic Chucking Turret Lathes (replacing four old automatics). Average machining time has been cut 50%. Setup is 19% faster. Workpieces include long and unwieldy drifter, paving breaker and jackhammer cylinders, washers, handles, cylinder heads and gear blanks for rock drilling equipment.

Shown above is a typical setup for the Universal jackdrill cylinder, held by the operator. The fixture used here provides a 12% saving in chucking alone. Replaceable V-blocks and an adjustable base allow cross, length and height adjustment to accommodate three different cylinders.

Interrupted facing is handled by cross-slide tools. Two drills and three



Operator holds Universal jackdrill cylinder 12 $\frac{1}{4}$ " long, 4" maximum face diameter. Note internal machining and interrupted cut on face. Hex-turret-mounted, multi-diameter cutters simplify machining... assure maximum accuracy.

Two additional cylinders handled with same chucking fixture. Note interrupted cuts and deep hole drilling performed by Fastermatic, 50% faster than by former methods.



multiple-diameter cutters on the hex turret drill, face and chamfer the 3-diameter bore, completing the part.

Versatile fixturing simplifies chucking of odd-size parts... allows automatic small-lot production. Smooth hydraulic feeds, and machine rigidity permit maximum metal removal. Automatic cycle permits operator to handle two machines.

For complete facts on 2F Fastermatic write in No. 6749 on inquiry card.



HOW FISHER GOVERNOR CO. BOOSTS PROFITS ON ODD JOBS Turret lathes provide faster setup, more parts per shift

Held in face-plate clamping fixture, steel cooling fin head casting is drilled, bored, reamed and chamfered from the hex turret. Square turret tools face, turn and groove. This setup was made to machine four parts.



Any producer has a number of odd machining jobs that must be worked into the daily production schedule. Setups may be required for even a single rush-order piece. Floor-to-floor time on these small lots is important—but not so important as machine flexibility and fast change-over. This is where Gisholt MASTERLINE Turret Lathes pay big dividends.

Fisher Governor Company, Marshalltown, Iowa, uses a battery of 36 Gisholt Ram and Saddle Type Turret Lathes to handle standard production items and odd jobs at lowest cost.

The setup shown, on a Gisholt 2L Saddle Type Turret Lathe, is specifically for small-lot work. Using the same basic clamping fixture, hex and square turret tooling, the 12 pieces shown were machined in just one 8-hour day. Eight different setups were required: one each for a 2-piece and a 4-piece lot; and one each for six

pieces. F.t.f. times ranged from 8.2 to 18.8 minutes, depending on size and type of part.

Your costs can be cut, too, with the same turret lathe features that meet Fisher Governor Company's requirements for accuracy and production. Gisholt Turret Lathes are heavier... offer more horsepower... are built to remove more metal to closer tolerances in a given amount of time. Quick setup, ample capacity, low tooling costs and a wide range of easily selected speeds and feeds, plus production-proved accessories, will make light work of your toughest jobs.

Twelve parts requiring eight different setups completed in one 8-hour shift. Gisholt Turret Lathes assure flexibility, fast change-over and ease of operation for more profits on short runs.



Eleven other parts—requiring eight different setups, completed in one 8-hour shift on the versatile Gisholt 2L Saddle Type Turret Lathe.

For complete facts on 2L Saddle Type Turret Lathes write in No. 7749 on inquiry card.



No. 9-1059
749

The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT

MACHINE COMPANY

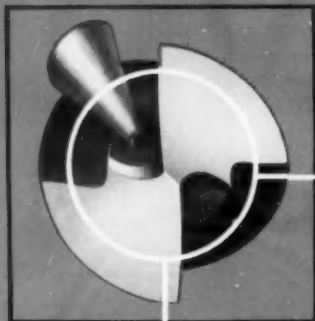
Madison 10, Wisconsin

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TWICE THE HOLES

IN HALF THE TIME...



**THE
PATENTED
RIB** that
cannot be
duplicated

**SPECIFY
SPEEDICUT "CHIPBREAKER"
SPEED WITH SAFETY**

with the new SPEEDICUT "CHIPBREAKER,"

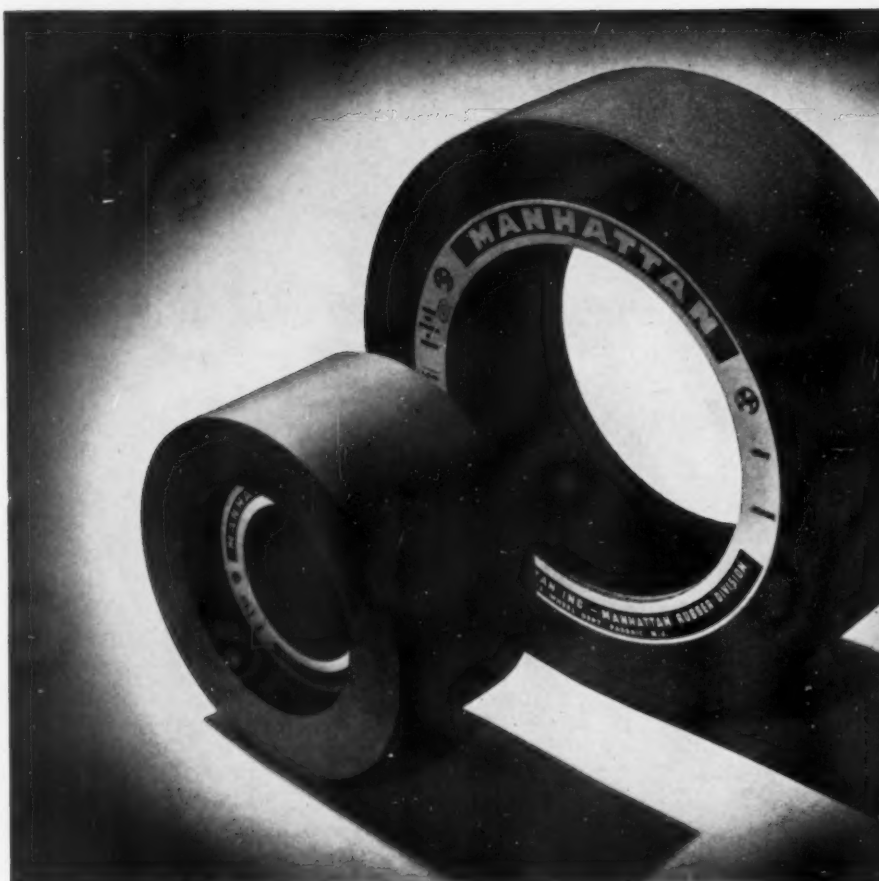
the drill with the patented rib that permits 50% to 400% higher feed rates, cuts production time and costs.

Have the SPEEDICUT "CHIPBREAKER" demonstrated in your own plant on your own equipment and type of work. Write for literature and name of your local authorized distributor.

SPEEDICUT DIVISION, CHICAGO HEIGHTS STEEL CO. • CHICAGO HEIGHTS, ILL.

USE READER SERVICE CARD, CIRCLE 14

USE READER SERVICE CARD, CIRCLE 15



ROUGHING AND FINISHING WITH the Same Manhattan Centerless Wheel

Finishing operations can be done with the same Manhattan Centerless Wheel used for roughing . . . simply by controlling the feed rate and the amount of stock removed! Manhattan's special natural and synthetic rubber bonds account for this important time and cost saving advantage. High grit-carrying capacity of the bond permits *more* metal removal with *fewer* passes—produces the desired finish to the most rigid dimensional tolerances. No need for time-consuming wheel changes with Manhattan Centerless Wheels. For thru-feed work, you can't buy more grinding efficiency and economy, nor at higher cost!

Manhattan Rubber Bonded Centerless and Regulating Wheels are engineered to meet specific requirements of your centerless grinders. Regulating Wheels are supplied either plain or core-mounted. Manhattan Core Mountings can assure substantial savings in wheel costs. Let a Manhattan representative show you how you can get "More Use per Dollar" with Manhattan Centerless Wheels . . . and other types of high speed, heavy duty abrasive wheels.



WRITE TO ABRASIVE WHEEL DEPARTMENT

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RAYBESTOS-MANHATTAN, INC.

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**MORE OUTPUT
PER WHEEL**

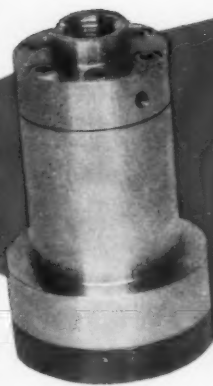
FEWER PASSES

**HEAVIER
REMOVALS
PER PASS**

**BETTER
FINISHES**

**LONGER
WHEEL LIFE**

RM982

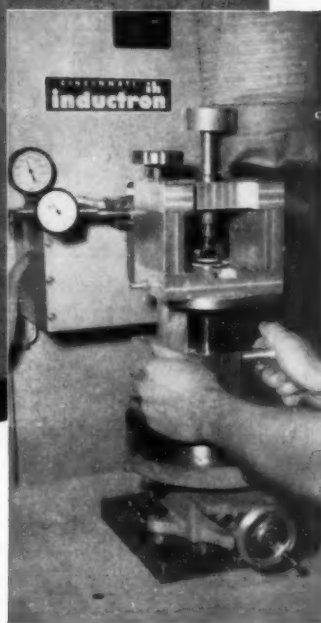
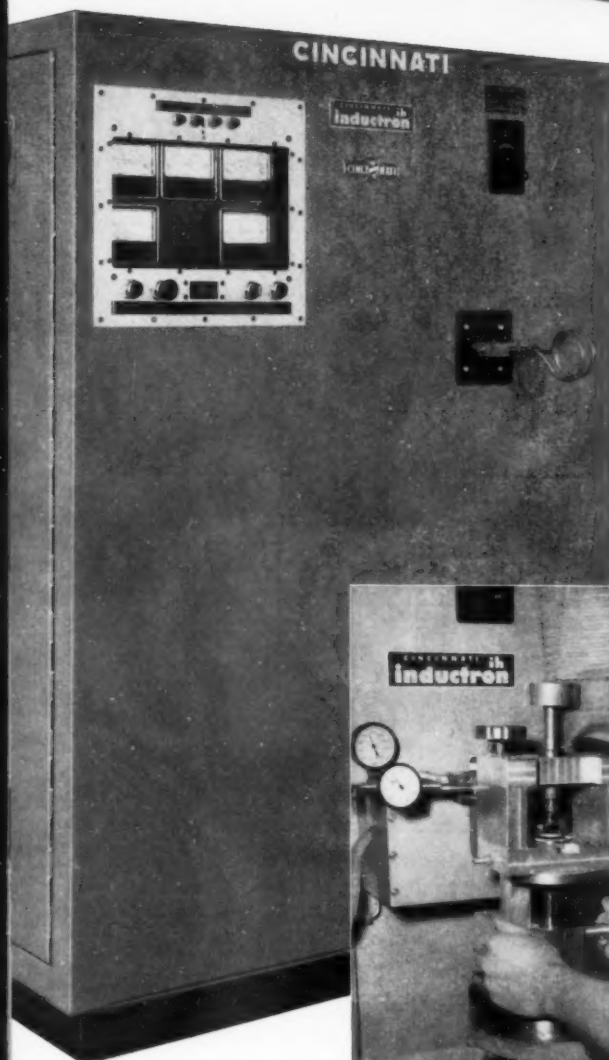


with just a KISS of

CINCINNATI Inductron[®]
precision-brazes Statham
Pressure Transducers



kc's



Photos above show Cincinnati Inductron induction heating machine and close-up of fixture used to braze 150 different sizes and styles of pressure transducers. Hose over fixture exhausts heat. One type of completely assembled Statham Pressure Transducer is shown, above, actual size.

Statham Instruments, Inc., Los Angeles, required a brazing operation before the final assembly of their extraordinarily accurate pressure transducers. These instruments record pressures ranging from fractions to thousands of psi. Among other sensitive components, the coils in these instruments are wound from wire so fine that it floats in air. To braze these transducers, the heat must be precisely located and applied . . . or a nearly complete, accurately adjusted instrument will be destroyed.

Because of its precise control of high frequency output (up to approx. 1200 kc) a Cincinnati 15 KW Inductron was the economical solution to this assembly problem. Brazing three joints is typical of the work accomplished. Using a calibrated fixture on an adjustable table for exact work positioning, the joints are quickly brought up to brazing temperature. The heat cycle for some transducers is but 0.2 second—just a kiss of 1000 kc's. With the Inductron's variable output RF transformer—rotating a dial varies the heating characteristics of the coil—only 25 different coil forms are needed to braze 150 instrument sizes and styles.

For your heat processing work, look to the Cincinnati Inductron for lowest cost induction heating . . . and to the Cincinnati Flamatic for lowest cost flame heating. Call in a Meta-Dynamics Division field engineer for full details.

**inductron
flamatic**
hardening machines

META-DYNAMICS DIVISION
Machines for Metal Forming and Heat Treating

THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio, U.S.A.





A new cutting fluid that *with any single-point*

Shell's experience in the last 3 years proves that Shell Dromus Oil E can give production increases of at least 25% with comparable cost savings.

Incredible as this may seem, Dromus® Oil E alone accounts for these considerable production increases! And here's how simply Dromus E does it: Use Dromus Oil E (diluted with 20 parts water) at the correct cutting speed. Then, increase the feed rate by one-third and operate as before. You can get a 25% production increase . . . optimum conditions may show as high as 40% improvement!

Applies to wet or dry cutting. Regardless of whether you're now cutting dry, or with emulsions or heavy-duty oils, this simple increase of feed applies.

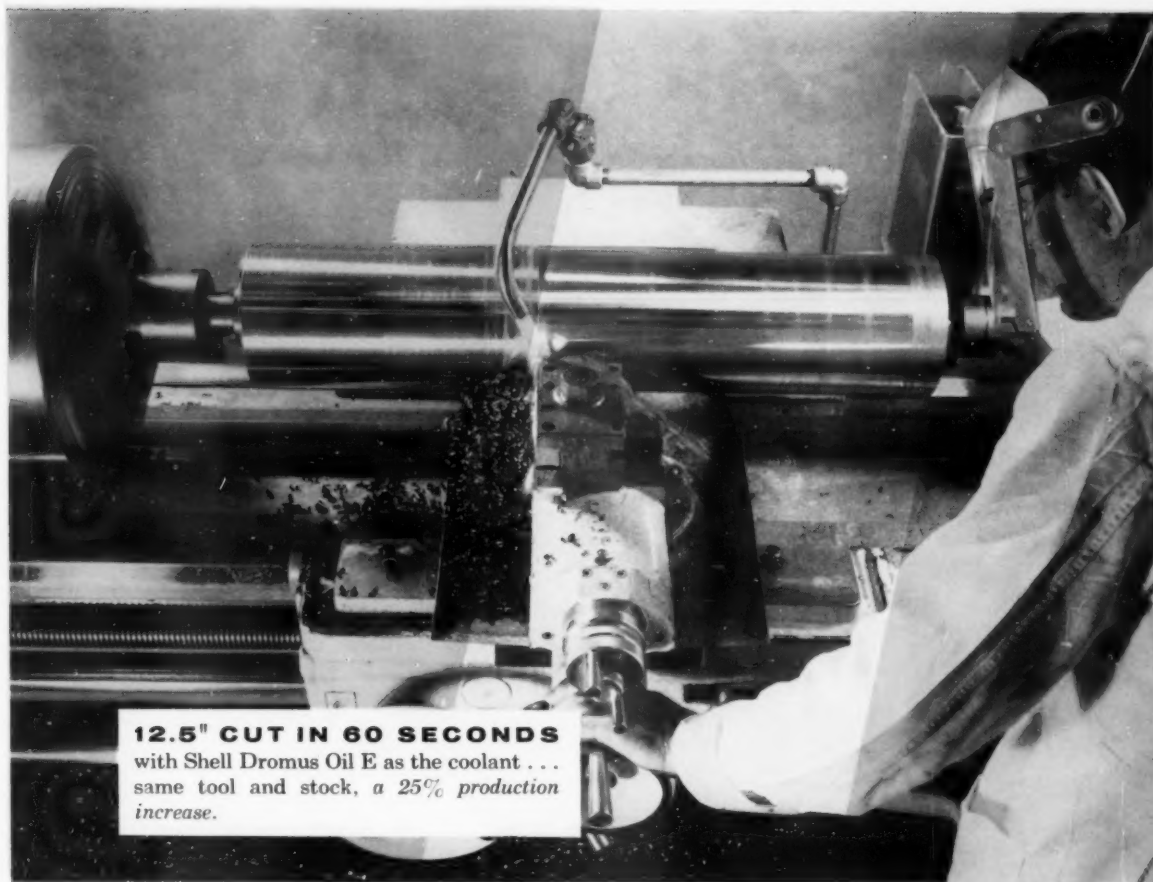
Applies to all milling, turret and automatic lathe set-ups. This is an across-the-board production im-

provement. If the machine can stand the extra 25% feed, the rule applies to all milling and turning jobs!

Applies to set-ups as they are . . . no changes required. There isn't a single thing that has to be changed or adjusted . . . just the feed and provision for keeping the work wet with Dromus E.

Shell Dromus Oil E offers these many other outstanding benefits too!

1. Greater worker safety—chips are cool.
2. No fire hazard—Dromus E is nonflammable even after water evaporation.
3. Closer dimensional tolerances can be obtained—less heating of the work piece occurs.
4. Brighter surface finish is obtained.
5. Excellent protection against rust.



12.5" CUT IN 60 SECONDS
with Shell Dromus Oil E as the coolant . . .
same tool and stock, a 25% production
increase.

permits **25%** greater feed (AT FULL SURFACE SPEED) **carbide "throw-away" insert**

Dromus Oil E is one of those products that comes up once in a generation. Rather than attempt to offer proof after proof of what this announcement offers, we simply invite you to let the Shell Industrial Products Representative show you what Dromus Oil E can do in *your* plant! Please write Shell Oil Company, 50 West 50th Street, New York 20, New York, or 100 Bush Street, San Francisco 6, California. In Canada: Shell Oil Company of Canada, Limited, 505 University Avenue, Toronto 2, Ontario.

SHELL DROMUS OIL E

THE NEW COOLANT FOR METALWORKING



*To prepare
aluminum for
better service*

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 FIELD SERVICE MEN • OVER 160 MATERIALS



Avoid aluminum fabricating problems with proper conditioning

This is true of all metals—the better the surface is conditioned for subsequent treatment, the better the results in service. Aluminum is no exception. For example:

In welding aluminum . . . complete deoxidizing helps prevent spattering and blow outs, gives welds of uniform shear strength

In painting aluminum . . . pre-paint conversion coatings provide tight paint bond, assure long-lasting protection against corrosion for the painted surface

In general cleaning of aluminum . . . use of proper cleaners removes all soils with complete safety to parts

In forming aluminum . . . proper lubricants smooth the fabrication process without harm to the metal surface or dies

In etching aluminum . . . produce a mat finish as you clean; or actually etch away excess metal

Oakite now has more than 30 materials especially qualified and guaranteed for proper aluminum conditioning.

There are etching and non-etching cleaners, drawing lubricants, barrel finishing compounds. Also paint strippers to reclaim rejects safely. And to assure better paint adhesion with improved corrosion resistance, you can't beat the Oakite *ChromiCoat* conversion coating process.

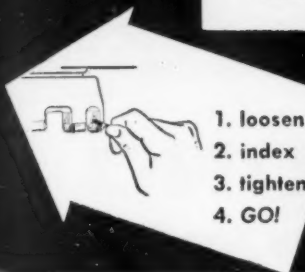
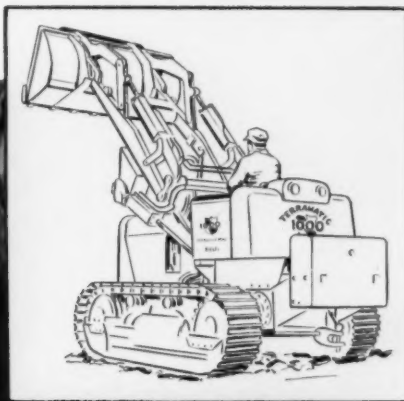
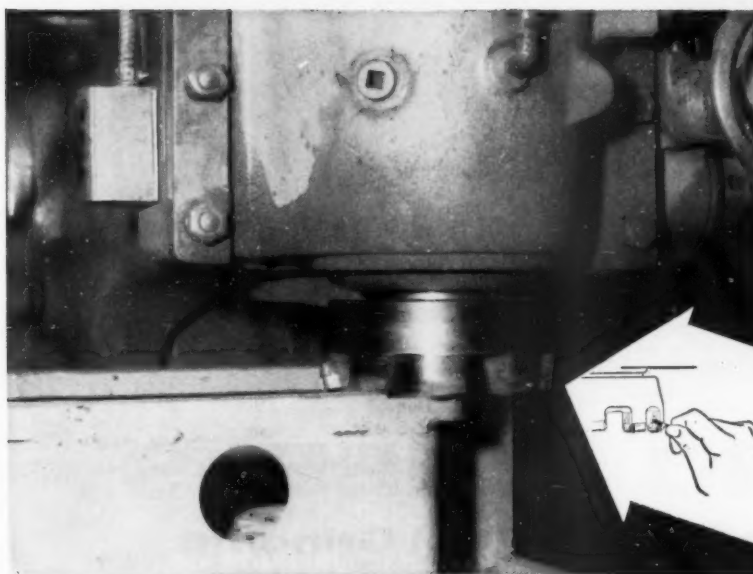
If you're working with aluminum and want to get the most from it, call in the Oakite man. Or, write for booklet F-8283 on conditioning special metals. Oakite Products, Inc., 45B Rector Street, New York 6, N. Y.

it PAYS to ask Oakite





Milling Cutters are dependable says J.I.CASE



1. loosen
2. index
3. tighten
4. GO!

16 months of continuous milling on TERRAMATIC transmission housings

It's no "pink tea party" when you chew a quarter-inch of rough 1015 Weldment Steel casting — spinning the milling cutter at 800 s.f.p.m. That milling cutter's got to be tough — *plenty tough* — and the carbide inserts need real "backbone."

J. I. Case found the right combination in V-R Face Mill Cutters with V-R throw-away carbide inserts. Big demand for Case Terratrak dozers, diggers, and crawlers, with Terramatic

Transmission, has kept production lines humming — 2 and 3 shifts a day — 16 months continuous production. In this picture there's no place for excessive downtime, or delays for tool regrinding. V-R Face Mill Cutters provide cutting edges right on the job — a turn of a wrench — index the insert to a new cutting edge — tighten — and away you go! (Minimum maintenance problems, too: in 16 months production only 3 sets of main screws and 1 chip breaker plate needed replacing.)

Your V-R representative has the facts on Face Mill Cutters and all carbide cutting tools — call him in today or send for Catalog VR-58.



FM-734

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PRIME MANUFACTURERS OF REFRACTORY METALS ENGINEERED FOR THE JOB

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ABRASIVE CO.

DIAMOND WHEELS

Finest Quality for Carbide Tool Grinding

MAN-MADE OR NATURAL DIAMONDS

Precision made for best grinding performance . . . a product of the most modern manufacturing using latest techniques and most accurate equipment and tools, including air gauges. Highest mechanical accuracy, closest tolerances and balance for best running truth. Three-stage curing process assures closest duplication. Exact and true concentrations.

Man-made or natural diamonds in resinoid and vitrified bonds — metal bond in natural diamonds. Up to 35% improved grinding ratios regularly obtained with man-made diamonds on many applications.

Send for new, complete 48-page catalog with consumer net prices for all sizes, shapes, concentrations and diamond depths, form ESA 290.

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DIES TO WORK MICA AS PRECISELY AS THIS

require the critical inspection that only the Kodak Contour Projector provides.

SPECIAL HIGH-PRECISION DIES are needed to stamp out an intricate mica blank like this, used for positioning electronic tube elements.

Tolerances are on the order of $\pm 0.0002"$. In making such dies the firm of Schneider and Marquard, Inc. (specialists in punches and dies for precision mica products) was not satisfied with the accuracy limitations of ordinary inspection methods, and turned to *optical* inspection.

Even then, they found that only one instrument could provide the extremely precise degree of inspection needed, with unparalleled accuracy on all parts of the screen image. That instrument was the Model 30 Kodak Contour Projector.

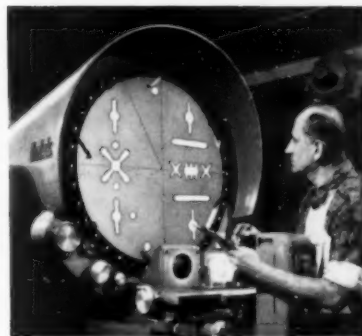
Accuracy, plus... With this large-screen (30-inch) comparator you get a projected image that's as *free* from distortion as the science of optics will permit—accuracy on *every* inch of the

viewing screen, including the very edges.

You get a sharp, high-contrast image that's erect and unreversed at all magnifications. Changes in magnification can be made at the flick of a switch.

More refinements... You also get efficient head-on surface illumination and a full 16" throat clearance between collimator lens and front mirror. This clearance is constant at *all* magnifications, permits staging of large parts without repositioning. The many other advanced refinements, extreme optical stability, and rugged construction of the Model 30 Kodak Contour Projector make it a leading choice for large-screen precision micrometry or routine gaging.

Cut inspection costs... Along with accuracy, optical gaging with Kodak Contour Projectors offers you savings in tool costs, increased inspection rates, and the economies that result from a minimum of operator training.



You can use optical gaging almost anywhere in your plant...receiving, assembly, production, inspection, or toolroom. There are 6 Kodak Contour Projectors to choose from, one matched to your inspection needs.

Get all the facts. Write to:

Special Products Sales

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak
TRADE MARK



Cuts inventory, yet widens range of "custom" machining **GULF MAKES THINGS**

How do you maintain "custom" standards of machining, and yet hold down operating costs in the face of a constantly expanding diversity of projects?

That was the problem faced by the Rolling Mill Division of E. W. Bliss Company, Salem, Ohio. This division produces a wide variety of metal processing equipment, from machine tools of bench-top size to multi-million dollar rolling mill installations.

H. G. Gibson, Plant Engineer of the Rolling Mill Division, found the answer in just three of the multi-purpose cutting oils in the Gulfcut line. Gulfcut 21A, Gulfcut 31A and Gulfcut Soluble Oil proved effective over the complete range of tough machining jobs at the plant,

and permitted a wholesale reduction in oil inventory.

"Our alternative," reports Mr. Gibson, "would be a stockpile of individual cutting oils and special additives for individual jobs—with a resulting step-up in inventory costs. But these 3 Gulfcut oils meet *all* our machining requirements.

"In high-precision gear hobbing, for example, Gulfcut 21A—a sulfurized-mineral oil—dissipates the extreme heat rapidly and thus checks expansion of both hob and workpiece. Helps us hold tolerances within .001" in this operation.

"In the boring, facing and turning of large gear rings, Gulfcut Soluble Oil gives us the critical cooling required



Gulf man on the job checks precision-hobbed gears at Rolling Mill Division of E. W. Bliss, where Gulf helps make things run better. Left, Fred Sweitzer, General Superintendent. Right, William A. Stranko, Gulf Sales Representative.

Hobbing helical gears for rolling mill tables, on a 72" gear hobber, at Rolling Mill Division of E. W. Bliss Company. Hob is flooded with Gulfcut 21A, which helps achieve rough hobbing of .625" and finish hobbing of .090" on steel of 280-311 Brinell hardness. Pinion is cut at $7\frac{1}{2}^\circ$ helix angle in the illustration at left.

with 3 multi-purpose Gulfcut oils . . .

RUN BETTER!

and permits a feed of 325 sfpm with no loss in tool life.

"In a tough screw-cutting operation, where the piece is 25 feet long, Gulfcut 31A—a sulfurized-mineral-lard oil—helps us achieve the specified 16 micro-inch rms finish on highly polished screws used in steel mill roll changing units.

"In hundreds of other jobs, these 3 multi-purpose Gulfcut oils help us maintain our high machining standards on a low oil inventory."

Your plant can cut machining costs and upgrade production with Gulfcut oils. There's a grade for every need in the complete Gulfcut line. Call your nearest Gulf office or mail coupon for illustrated bulletins.



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Send me illustrated bulletin on

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and with greater reliability of measurement



Made in West Germany



Large Toolmaker's Microscope

CARL ZEISS, INC.

485 FIFTH AVENUE, NEW YORK 17, N. Y.

This large toolmaker's microscope, made by Carl Zeiss, is a decided improvement over former instruments. It offers greater ease, greater rapidity and greater reliability of measurement.

Has a measuring range of 3x6", permitting extensive application. Its new built-in gauge block displacement device makes it possible to quickly move the stage in the longitudinal direction in five steps and in the transverse direction in two steps, thus eliminating the old fashioned method of interchanging gauge blocks. All manipulations, adjustments and readings are performed from the same position in front of the instrument.

The inclined binocular tube can be tilted and adjusted to suit the convenience of the operator. During tilting, the image in the eyepiece always remains in focus. The object to be tested is seen simultaneously with the cross-line of the protractor. The scale of the protractor and templet, however, can be projected consecutively into the eyepiece.

BUILT-IN BEAM-SPLITTING DEVICE

Another novel feature of this instrument is the new built-in beam-splitting device with single or double reversed image in complementary colors for line-symmetrical or center-symmetrical measurements.

**A small toolmaker's microscope
is also available**

Write for literature

COMPLETE
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STARRETT NO. 254 MASTER VERNIER HEIGHT GAGE

Here is a vernier height gage that can be used with supreme confidence in its master precision.

An exceptionally rugged, rigid, vibration-proof gage with new open-face, easy-reading vernier, flush-fitted to eliminate parallax errors . . . full-length fine adjusting screw controlled by a convenient knob on the substantial, natural grip base . . . Starrett satin chrome finish for no-glare, easy reading . . . quick-adjusting screw release for fast slide positioning . . . hardened and stabilized master bar (only Starrett provides

hardened bars on vernier gages).

Shown used with a Starrett No. 711F Last Word Indicator, new No. 254 Master Vernier Height Gages are available in 12, 18 and 24-inch sizes, all reading direct from base over the full range.

Ask your Industrial Supply Distributor to demonstrate the many precision features of this new Starrett height gage. Call him for quality products, dependable service . . . or write for complete Starrett catalog. Address Dept. E, The L. S. Starrett Company, Athol, Massachusetts.



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PRECISION TOOLS

World's Greatest Toolmakers



Starrett Precision Makes Good Products Better

PRECISION TOOLS • DIAL INDICATORS • STEEL TAPES • GROUND FLAT STOCK • HACKSAWS • HOLESAWS • BAND SAWS • BAND KNIVES

Another new fastener idea from Parker-Kalon

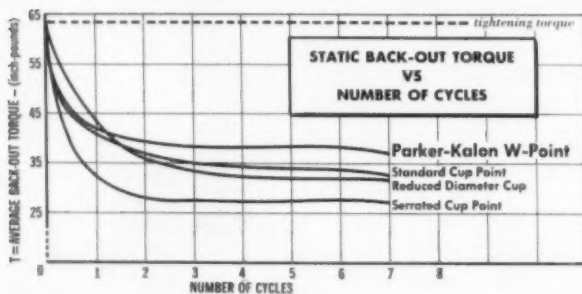
30% more back-out torque
50% more resistance to vibration
50% more resistance to rotary slippage

with the New **P-K® W-POINT** **SOCKET SET SCREW**

**NOW YOU CAN OBTAIN THE HIGHEST DEGREE
OF HOLDING POWER EVER ATTAINED**

30% MORE BACK-OUT TORQUE

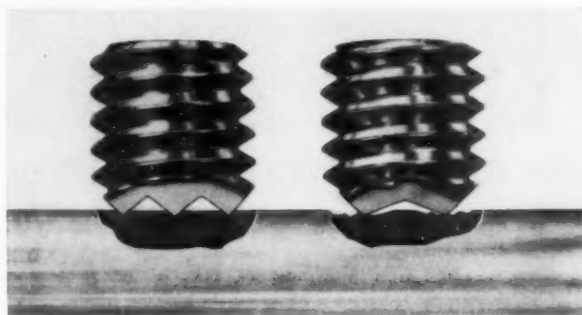
In a series of tests, performance of the new P-K *W-Point* was matched against that of small cup, serrated cup and standard A.S.A. cup point screws. A number of blocks and shafts were matched to precision tolerances for each of



the four set screws under observation. Again and again each screw was tightened on a new portion of the shaft, the screws loosened and the back-out torque recorded. Results were consistent and conclusive. In every test there was less decay in back-out torque for the new *W-Point* than for any of the other three types.

50% MORE RESISTANCE TO VIBRATION

In all tests under normal conditions of vibration, the other three types of set screws loosened and rapidly lost their holding power. Examination to determine the cause showed that with all other screws, final tightening caused them to deviate from the axial line through the center of the screw which in turn caused uneven tracking. The tests indicated that unless the cup point forms a true track in the shaft, vibration will result in loosening within a very short period of time. At the conclusion of each test run, the new P-K *W-Point* was still seated securely and in tight frictional contact with the shaft.



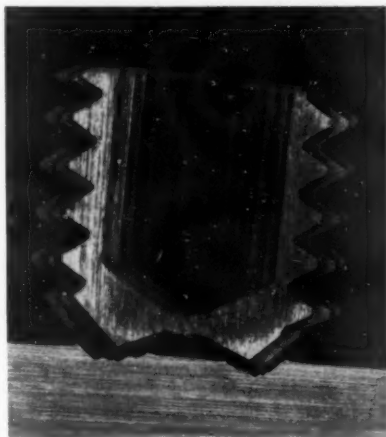
50% MORE RESISTANCE TO ROTARY SLIPPAGE

W-Point set screws, small cup, serrated cup and standard A.S.A. cup point screws were test-matched on various types and sizes of shafts at rest, in motion, and in start-and-stop operation. Examination of the impressions left on the work showed that all other types of cup point set screws when tightened, created tracks which are uneven in depth and shape. Impressions made by the new *W-Point* were perfectly circular and even in depth at all points on the circumference. There was also clear evidence of rotary slippage by the other cup point screws while the sharp pivot point of the *W-Point* Set Screw effectively prevented such slippage.

WOBBLE AND TIPPING CONTROL

Users of cup point set screws have long recognized two problems directly related to the proper seating of the screw on the work . . . "wobble" and "tipping". Until now, "wobble" could not be avoided because of the tolerance clearance which must be provided between screw threads and the tapped hole. In addition, users of conventional cup point set screws are aware of the fact that the key itself imparts a tipping movement to the screw during the tightening operation. The result of these two factors often results in a weakening of holding power. Upon completion of the torquing of a conventional cup point set screw, only a

part of the flank of the cup edge remains in frictional contact with the work. The guidance provided by the carefully engineered construction of the new P-K W-Point, reduces "wobble" and "tipping" to an absolute minimum—results in



true circular tracking by the cup edge with flanks in intimate frictional contact with the work. With "wobble" and "tipping" eliminated, the *increased contact areas* PLUS the *new pivot point* PLUS Parker-Kalon's uniformly finished Class 3A "ground thread" quality feature, provides the revolutionary W-Point with an inherent resistance to loosening . . . a *frictional grip superior to any type of cup point socket set screw now in use!*

TEST THE NEW W-POINT FOR YOURSELF

You are cordially invited to examine and test the new P-K W-Point socket set screw in your own plant. When you do, notice its precision manufacture, its perfectly finished ground threads, the well-defined last full thread. Like many important advances in technology, the W-Point



concept is simple and straightforward. In use, its superior performance and holding power will be demonstrated to your own satisfaction.

NO INCREASE IN COST

You get all the advantages of this revolutionary improvement in socket set screws *at no increase in price!* The W-Point is available in #4 to 1" diameters in Alloy, and #4 to 1/2" diameters in Stainless Steel . . . stocked in popular sizes. Other sizes made to order. Approved, Military Standards, 51017 through 51024.

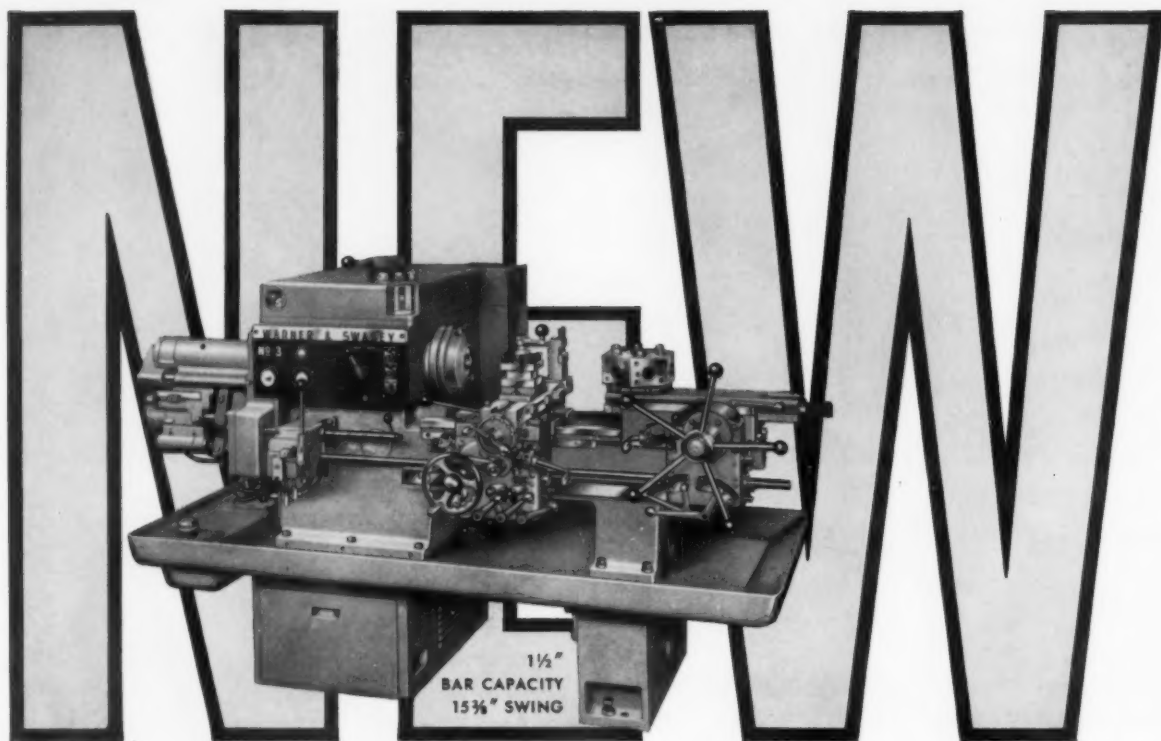
FOR SAMPLES AND COMPLETE TECHNICAL DATA, CALL YOUR P-K INDUSTRIAL DISTRIBUTOR, OR WRITE DIRECT TO P-K FOR BULLETIN NO. 1106

Look to Parker-Kalon for quality Socket Set Screws, Cap Screws, Shoulder Screws, Button Head and Flat Head Socket Screws, Pipe Plugs and Dowel Pins . . . the most complete line in the industry. PARKER-KALON, a division of General American Transportation Corporation, Clifton, New Jersey. Offices and warehouses in Chicago and Los Angeles.

PARKER-KALON

W-Point* Socket Set Screws

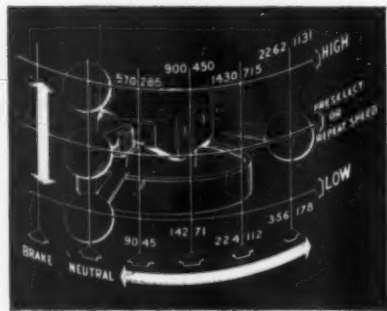
*Patent Pending



WARNER & SWASEY No. 3 ram type turret lathe



This is the new exclusive single lever headstock control...



This is how easy it is to operate

Unique, Automatic Headstock

More Speeds—Greater Range—The new eight-speed headstock (16 with a two-speed motor) gives you more speeds in a wider range—from 45 to 2262 rpm—for maximum metal removal efficiency.

Instant Speed Changes are made possible through exclusive, Warner & Swasey designed direct-acting hydraulic clutches (which never need adjustment) in combination with a constant mesh, helical gear train.

Full Power is always available at the spindle nose. Higher-powered motor is direct-mounted to eliminate drive maintenance problems.

Exclusive, Single Lever Preselector and Speed Control

On the new No. 3, preselection of speeds, speed change, brake and neutral are all obtained with the same lever.

No fumbling for speeds...no gear shifting. Just rotate the handle to preselect; move it up or down to engage new speed instantly.

No figuring...the direct reading preselector dial tells you the surface speed for each diameter and rpm.

No remembering (or forgetting)...the preselector drum lets you set up the sequence of cuts; numbered clips tell you where to find the speeds and their order of use.

Neutral (free spindle) and **Brake** are selected by rotating lever to the left.

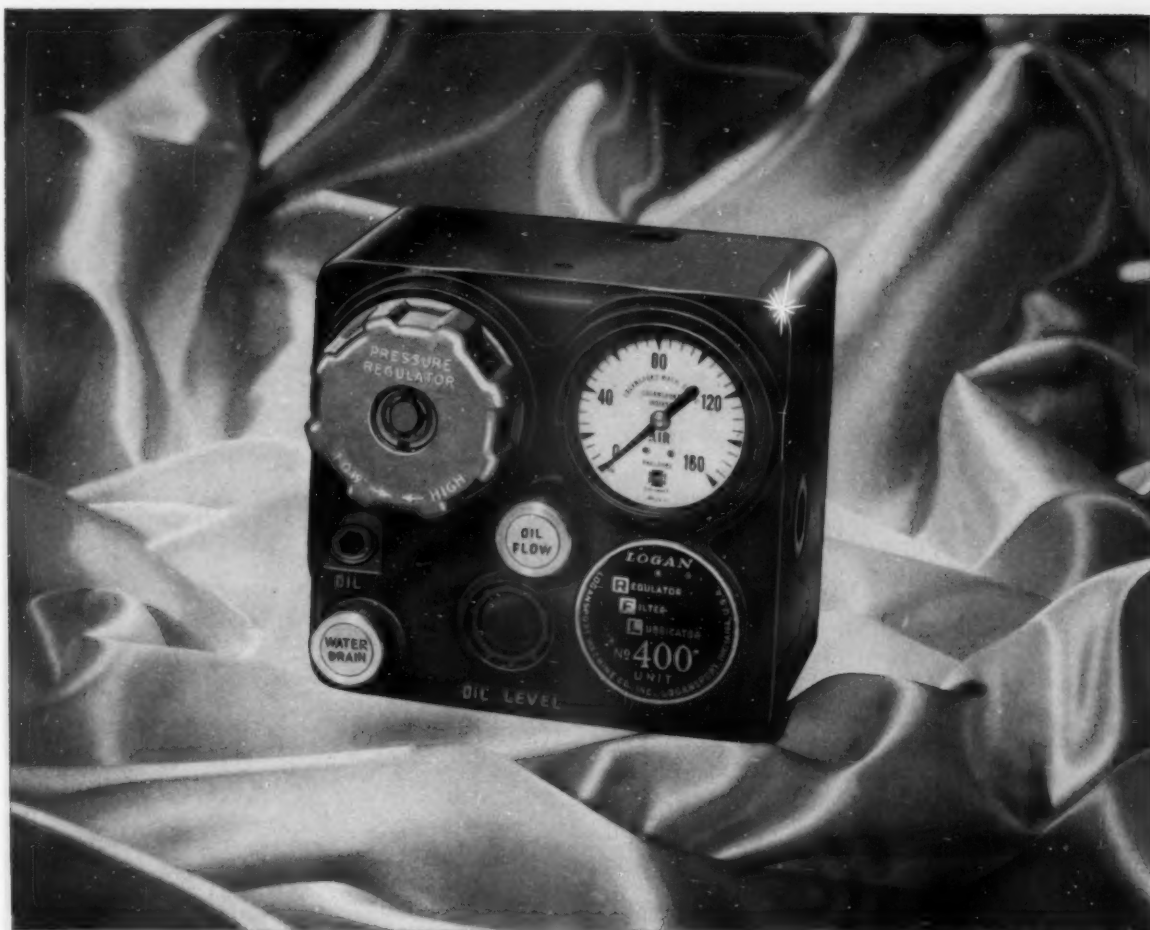


Warner & Swasey Co.
Cleveland 3, Ohio

You can produce it better, faster, for less...with a **WARNER & SWASEY**

USE READER SERVICE CARD, CIRCLE 27

The Tool Engineer



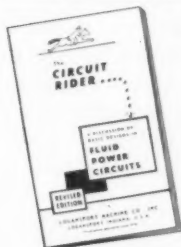
Illustrated—Logan Model 400 RFL Unit

Look to Logan

the ultimate in air circuit accessories

Logan RFL Unit, the designers choice for over a decade! Protects your air-powered equipment . . . regulates pressure . . . filters air . . . lubricates air. Adds years of dependable performance.

New Model 400, illustrated above, is a companion model to the well-known Model 600.



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MEMBER: Natl. Mach. Tool Builders' Assn.; Natl. Fluid Power Assn.

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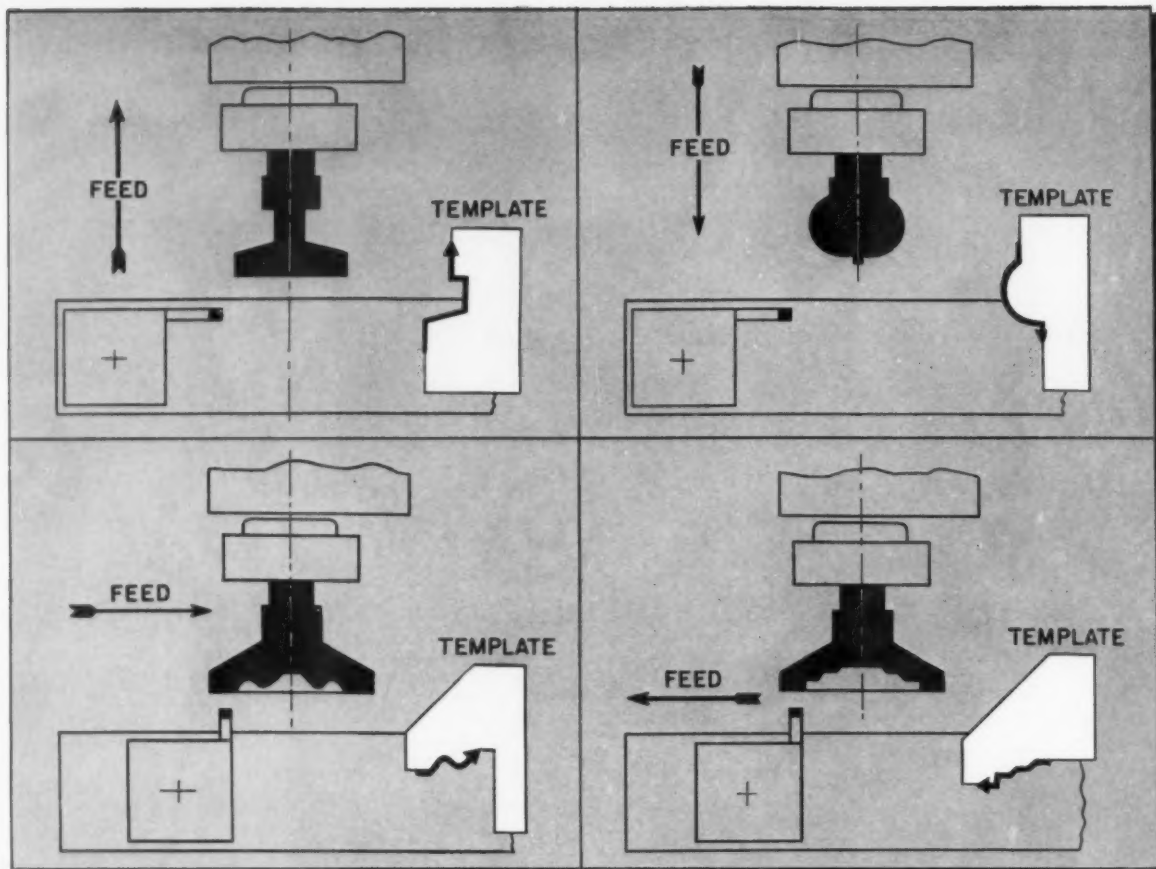
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ALL FOUR of these Automatic Tracing Cycles are available with a SINGLE Jones & Lamson Turret Lathe

How's this for machine flexibility in one chucking? (1) You get all of the accuracy and tooling combinations offered by the standard J & L Turret Lathe. (2) You have more than 180° of tool travel control in each of four different automatic tracing cycles (you don't *have* to have *all* four, incidentally). (3) You do both rough and finish tracing (*with rough and finish tools*) in the same set-up. (4) You multiple-tool your tracing operations through 180° of tool control. (5) You have complete control for diameter with the conventional graduated hand wheel on either mechanical or *tracing* operations. (6) The original full swing of the Turret Lathe is retained with this tracer. (7) A single lever disconnects the tracer for standard turret lathe operation.

**the man who needs
a new machine tool
is already paying for it**

Such flexibility enables you to perform an amazing amount and variety of work with this new *Two-Dimensional Tracer* on J & L Saddle Type Turret Lathes.

It all adds up to: MAXIMUM WORK COMPLETED IN ONE CHUCKING; REDUCED HANDLING TIME; INCREASED ACCURACY. Write for further information.



JONES & LAMSON

Machine Company • Dept. 710, 516 Clinton St., Springfield, Vt.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

Now—for FORM TOOLS

... complete Stock Service!

these 7
Grades regularly
stocked for form
tool applications...

- Electrite Double Six*
(Type M-2)
- Electrite Corsair*
(M3 Type 1)
- Electrite Crusader*
(M3 Type 2)
- Electrite No. 1*
(Type T-1)
- Electrite No. 19
(Type T-2)
- Electrite Vanadium
(Type T-3)
- Electrite Dynavan*
(Type T-15)

*Also available in XL® analysis
for improved machinability



LATROBE'S

fully-uniform DESEGATIZED®

HIGH SPEED STEELS

For stock sizes and technical assistance call your LATROBE
representative today! . . . or write for latest stock list.

LATROBE STEEL COMPANY
LATROBE, PENNSYLVANIA

**BRANCH OFFICES
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BOSTON • BUFFALO • CHICAGO
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HAVING BORE SIZING PROBLEMS

WITH
SIZE
ROUNDNESS
STRAIGHTNESS
TOLERANCE
SURFACE FINISH ?

One piece • Job lot • or Production run

... Sunnen Honing levels out all hole errors from previous operations with a minimum of stock removal. Corrects out-of-round, chatter, waviness, bow, taper, barrel, bellmouth. Guarantees bore accuracy to .0001" with controlled surface finish as fine as desired.

From stock removal through finish sizing — from deburring through micro-fitting, Sunnen Honing is the most economical solution for internal work. No fixtures or time consuming set-up required; no chucking pressure to distort the hole.

Range .100" through 2.625" with stock tooling — and through 4 1/2" with tooling built on order.

INVESTIGATE

the advantages of this fast stock removal process. Ask us for a copy of Bulletin SP-11 or an equipment demonstration in your shop. No obligation is involved.

SUNNEN
PRODUCTS COMPANY
HONING

7927-1 Manchester Ave. — St. Louis 17, Mo.
Canadian Factory: Chatham, Ontario



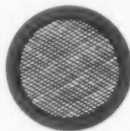
FAST STOCK REMOVAL



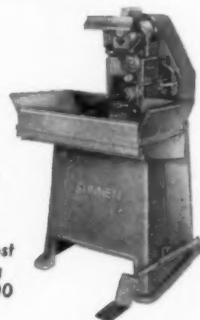
GEOMETRIC ACCURACY



PRECISION SIZING



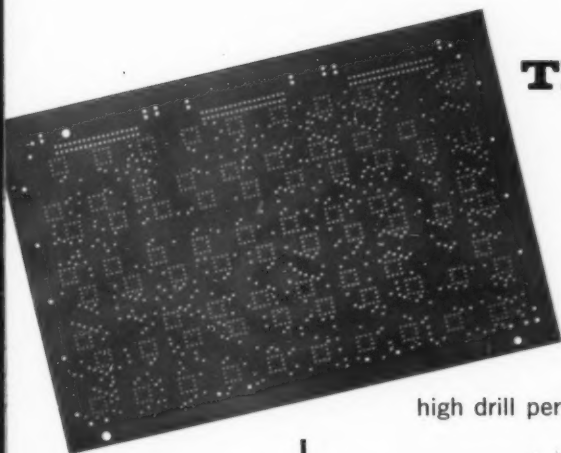
CONTROLLED FINISH



**PRECISION
HONING
MACHINE**

Average cost
with tooling
about \$1000

8880



On some plates such as this one, up to 1014 holes are drilled on one pass!

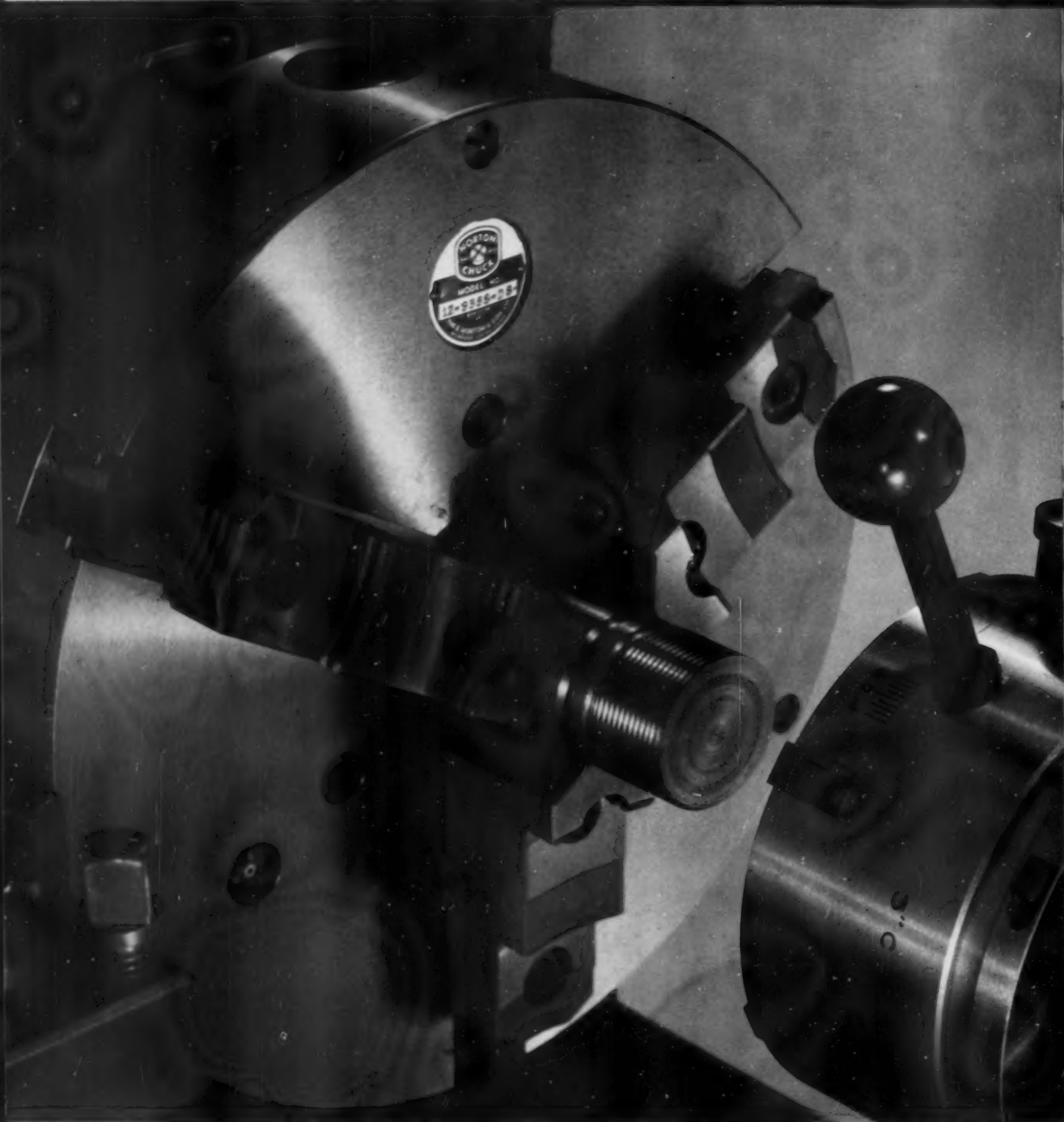
The odds are 579 to 1

Those are the odds on each drill in this setup at Burroughs Corporation's Tireman Plant in Detroit.

When a 3/32" circuitry panel of Epoxy glass, copper clad .0014" both sides, contacts these 580 "Greenfield-Ampco" drills, failure of any one drill would offset the efficiency of the other 579 on that pass. And each pass carries the same odds! So a job like this demands not only high drill performance, but highly uniform performance as well.

GREENFIELD TAP & DIE
GREENFIELD, MASSACHUSETTS

BUY FROM YOUR GREENFIELD DISTRIBUTOR FOR SERVICE AND QUALITY



CLASS 3 THREADS WITH HORTON CHUCK!

What do we mean, talking about chucks and class 3 threads in the same breath? Just this: unless the work is held concentrically and runs true, that die head which is the best there is for the job (Geometric, of course) cannot compensate for excessive "run out" in the chuck.

That's why you need precision chucks, for precision threading.

Running class three threads? Better check your chucks, "Chuck" out worn out chucks, and, replace them with new HORTONS.

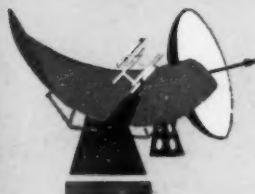
GEOMETRIC-HORTON, NEW HAVEN 15, CONNECTICUT



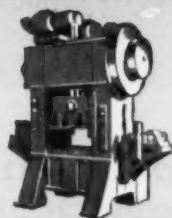
TO HELP YOU GRIND MORE FOR LESS



to help you



make more



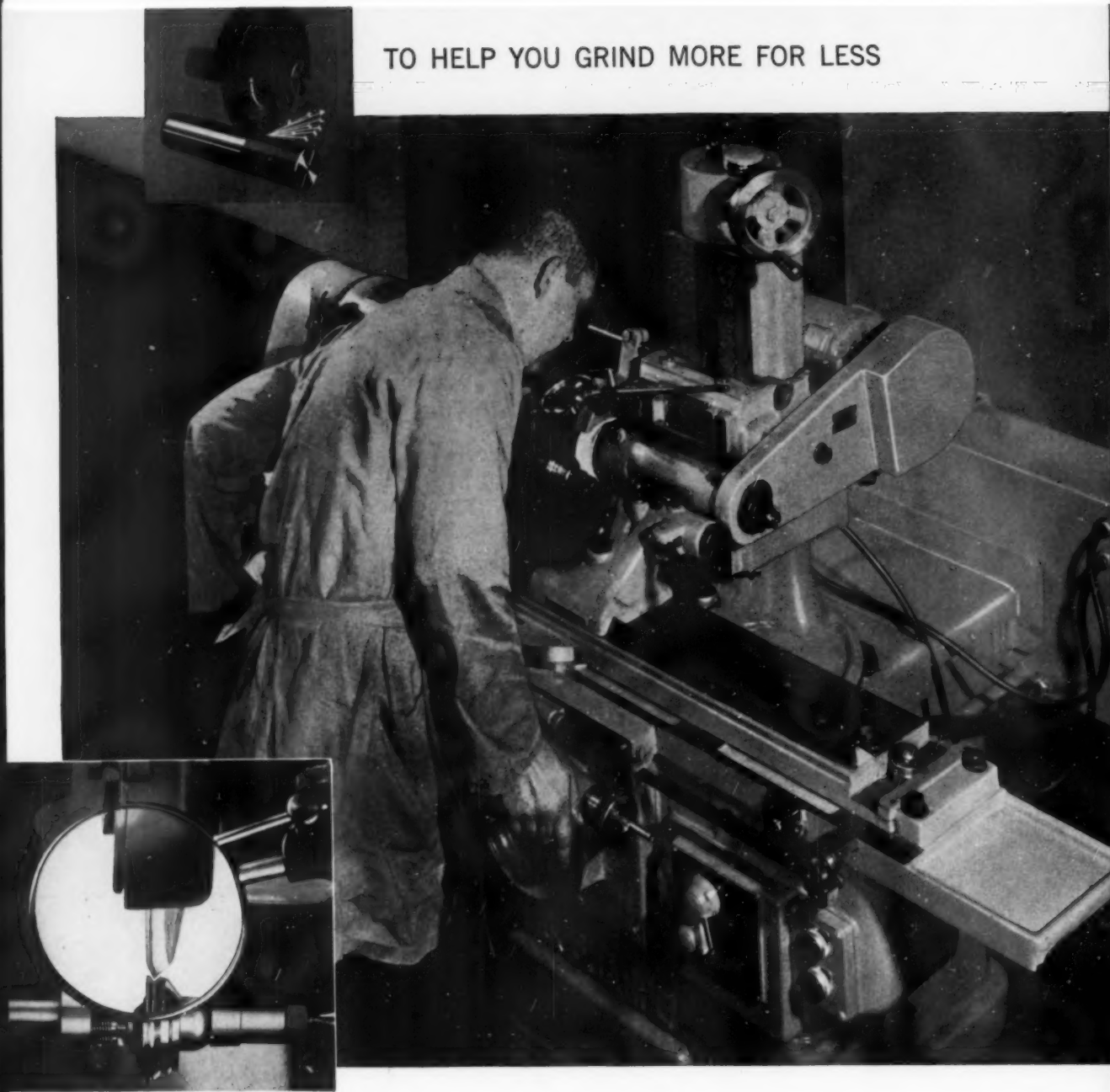
for less . . .



Brown & Sharpe  **PRECISION CENTER**

TO HELP YOU MILL MORE FOR LESS

TO HELP YOU GRIND MORE FOR LESS



Two-machine output from single-machine investment— No. 13 tool grinder doubles for production

The Brown & Sharpe No. 13 Universal and Tool Grinding Machine is the leading choice in its class for all-around utility. Watch it turn out the work anywhere it's installed, and you'll see why.

It grinds helical and formed cutters, end mills and side mills—meets every need for tool sharpening. It is industry's favorite for circular form tool grinding. It offers unlimited adaptability for tool and die making,

and for grinding parts needed in experimental, prototype, and repair work. In addition, it has ample capacity for a wide variety of light production grinding.

Now, new improvements in drive design further increase its proved efficiency. Find out how the No. 13 can start saving for you.

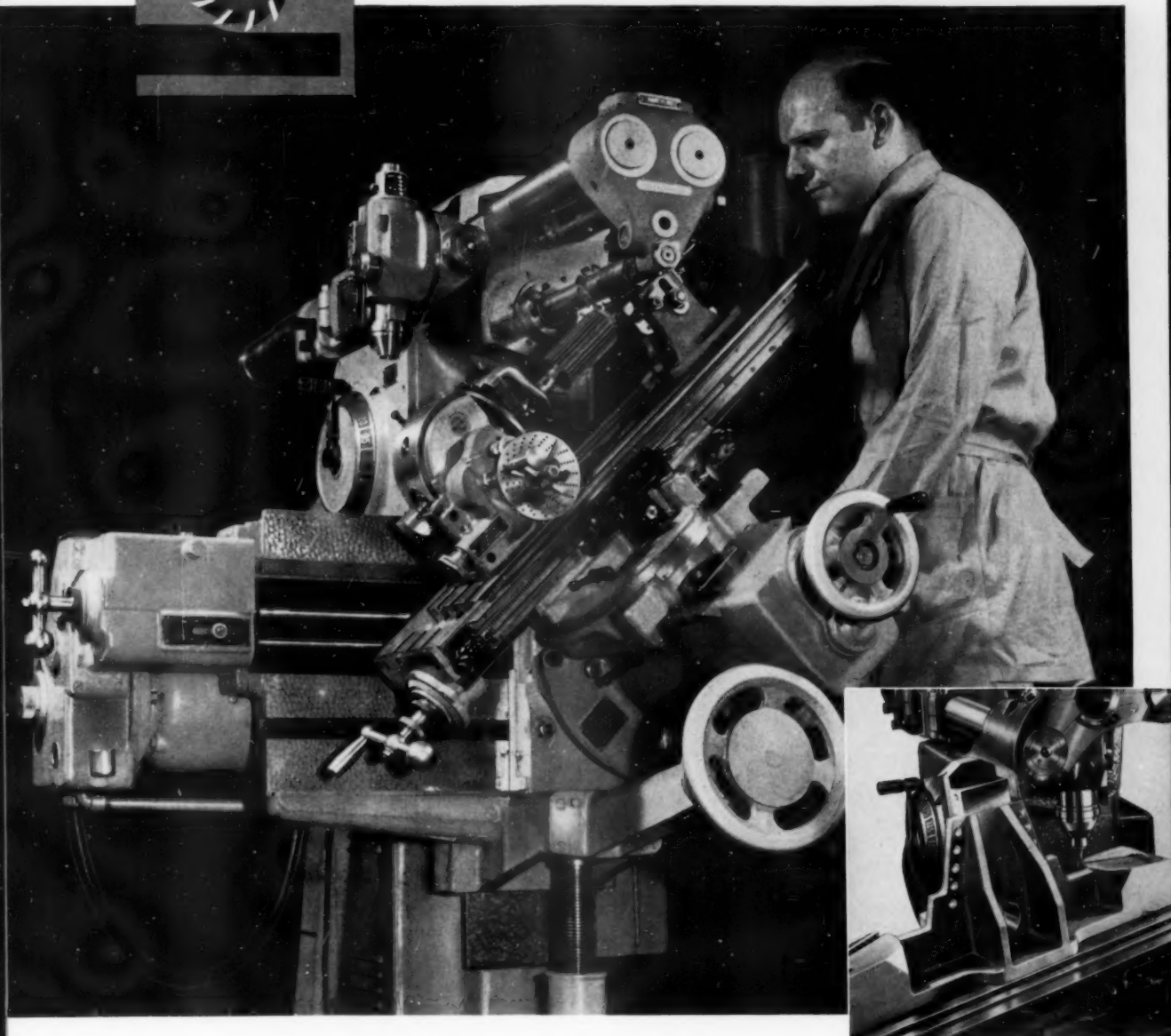
For details, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

Brown & Sharpe  **PRECISION CENTER**

USE READER SERVICE CARD, CIRCLE 35



TO HELP YOU MILL MORE FOR LESS



**The Omniversal makes the cuts that "can't be done"
- meets today's demands for toolroom milling**

The Brown & Sharpe Omniversal Milling Machine is a standard machine "made-to-order" for the complex milling increasingly required in toolroom, experimental, and prototype work. Nothing else can match its combination of work-range, versatility, and dependable accuracy.

It simplifies the multi-operation jobs—permits milling at various angles without relocating work—saves set-up time. It handles spiral taper and other complex cuts that

are impossible on other machines. Plenty of capacity, too—with a total horizontal feed of 34", and a 15" vertical adjustment.

When you invest in toolroom milling equipment, get the machine that will do *all* the work, and pay top returns in dollars saved . . . get the Omniversal.

For details, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

TO HELP YOU DRILL MORE FOR LESS

Drill • tap • bore • ream... 2 to 5 times faster

Turret drilling, developed by Brown & Sharpe's newest division, is the revolutionary system for production drilling operations that can save up to 80% of your costs for conventional gang-drill box-jig methods.

Multiple drilling operations are performed at a single station, with one set-up. Brown & Sharpe Work-positioning Tables permit accurate duplication of any hole pattern, eliminate need for expensive box jigs. You save work transfer and set-up time. You save on tool wear and maintenance. You save floor space, and reduce your capital investment. In many installations, Brown & Sharpe Turret Drilling equipment has paid for itself in a year or less.

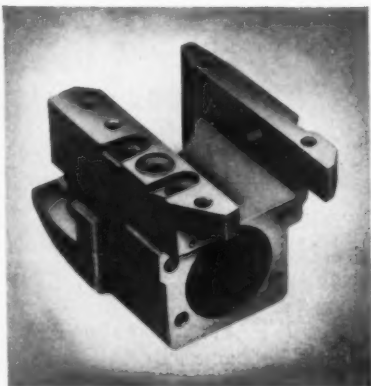
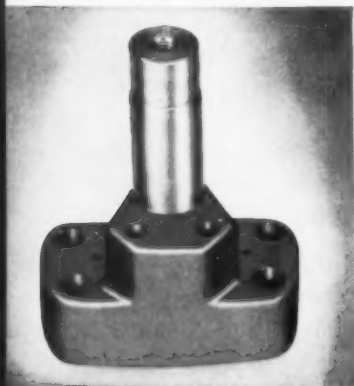
Write for complete information, and ask for estimate of savings you can make by tooling up for B&S Turret Drilling. Brown & Sharpe Turret Drilling Division, Inc., 20 Fitch St., East Norwalk, Connecticut.

The Stanley Works speeds drilling production with Brown & Sharpe Turret Drilling Machines

At The Stanley Works, New Britain, Conn., B&S Model A Turret Drilling Machines are used to lower costs of drilling component parts for the pneumatic operating units of the famous Stanley MAGIC-DOOR Controls. In the spindle (left), an SAE 1035 steel forging, four .432" holes are drilled and reamed, two .307" holes drilled and reamed, and two .149" holes drilled — 14 operations in 4 minutes. The B&S Work-positioning Table and the simple holding fixture assures accurate hole location.

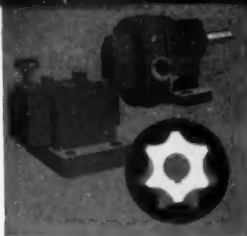
In the cylinder block (right), 11 holes are drilled and tapped, 1 hole drilled and counterbored, and 5 holes drilled. All 17 holes — 29 operations in four planes — are completed in 7 minutes.

Two sizes: Model A (shown) 6 spindles • $\frac{1}{2}$ " drilling and tapping capacity in steel • table work surface 22" x 24". Model B 6 spindles • 1" capacity in steel • table work surface 28" x 32" • may be equipped with any standard numerical (tape) control system for fully integrated automatic work positioning and machining.



Brown & Sharpe  **PRECISION CENTER**

USE READER SERVICE CARD, CIRCLE 37



TO HELP YOU HANDLE FLUIDS
MORE EFFICIENTLY...AND FOR LESS

New Double A "Circuit-Stak" Valves save up to 75% of installation costs

Circuit-Stak valves are a new Brown & Sharpe concept: a "sandwich" of several valves required for a hydraulic circuit, assembled in one compact unit on a single sub plate.

You save up to 75% of the usual installation cost for separate valves, because Circuit-Stak installs as easily as a single valve — eliminates separate mountings and piping runs. Valves in the sandwich can be easily removed or replaced.

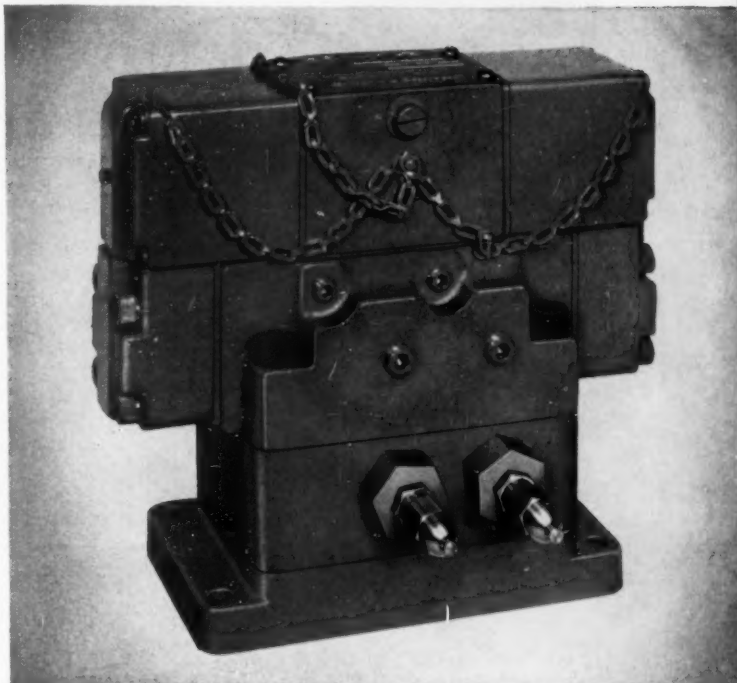
For literature on Double A hydraulic control valves, power units, Gerotor pumps, write Double A Products Co., a subsidiary of Brown & Sharpe Mfg. Co., Manchester Michigan.

B&S "stock" pumps meet tough requirements in "Votator" units

The reasons why Brown & Sharpe rotary geared pumps have been built into "Votator" vegetable-shortening and lard processing units for over 15 years, are important to any pump user . .

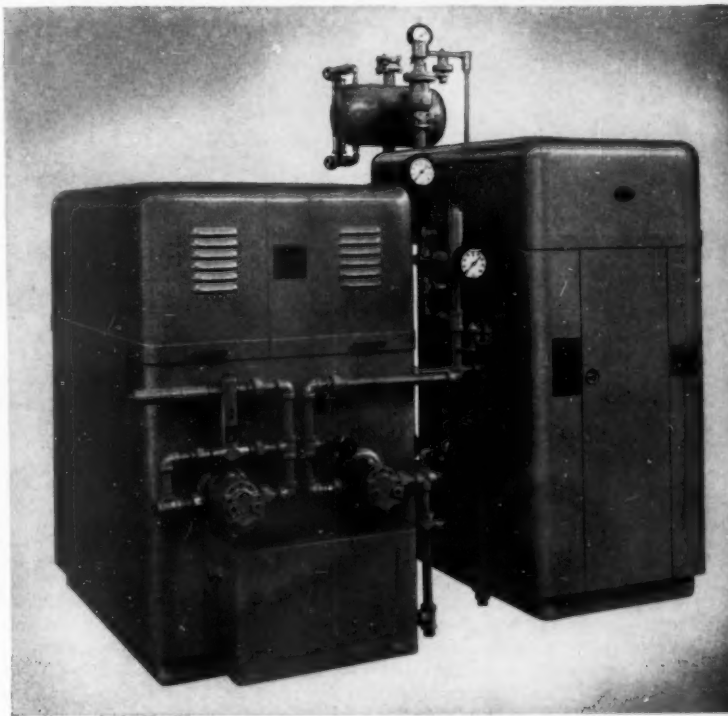
First, B&S tolerances between moving parts are so close that they reduce slippage of hot oils to an absolute minimum — at 250-300 psi. Second, B&S fine internal finishes assure extra-long service life. Equally important, the B&S pumps that meet Votator requirements so well are *in-expensive* — available right from stock.

Send for your copy of the new Catalog No. 36P, which describes the complete line of B&S gear, vane and centrifugal pumps. Brown & Sharpe Mfg. Co., Providence 1, R. I.



Above: Simple Circuit-Stak combining double flow control valve, "sandwiched" under 4-way valve, costs about \$36 less to install than if valves were separately mounted.

Below: Famous Votator chilling and plasticizing units for shortening and lard are manufactured by Girdler Process Equipment Division, Chemetron Corporation, Louisville, Ky.



Brown & Sharpe  **PRECISION CENTER**

USE READER SERVICE CARD, CIRCLE 38

TO HELP YOU MAKE PRECISION MEASUREMENTS
EASIER AND FASTER...



New Brown & Sharpe Convertible Thimble Micrometer

Precision Tool News

3 new B&S features make this the world's most advanced micrometer

Only in Brown & Sharpe's new Convertible Thimble Micrometer do you get these 3 important features for convenience and accuracy...

First, you can use either of two measuring "feels" in the same micrometer. By just turning a friction control, you convert in seconds to "friction" feel or... direct feel (knurled sleeve locked to thimble.)

Second, you use this mike, easily, in one hand. The friction sleeve is placed where you can reach it without stretching, and the new lever-type lock works with your thumb.

Most important, for accuracy, are the new oblique (slanting) barrel graduations. By showing "where you're going and where you've been", they prevent the .025", one-revolution errors that often occur when older style, straight graduations are hidden. Range is 0-1", in .0001".



New Brown & Sharpe pre- colored flat stock saves time

Brown & Sharpe's new Ready Mark precision ground flat stock comes with a smooth, rust-resistant colored finish — ready for scribing. You save degreasing, coloring, drying time. Coating instantly identifies stock; it's blue for oil-hardening, maroon for air-hardening stock.

Ask your local Brown & Sharpe distributor to show you these products, available quickly from his stock. Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

New Intrimik measures diameters in .0002" to bottom of blind bores. This Style B Intrimik is an advanced version of the famous internal tri-point micrometer that Brown & Sharpe introduced 5 years ago. It is very versatile because it measures diameters, directly, right to the bottom of holes — extra long-lasting because measuring points and all wearing parts are carbide; wear adjustments are provided. Self-centering, self-aligning points are protected from damage by not protruding beyond end of head. Available in six sizes, with setting rings and extensions — individually or in sets — for measuring diameters from .600" to 2.400" in .0002", to depths of 14". Accurate over full range to .00015".

Brown & Sharpe  **PRECISION CENTER**

USE READER SERVICE CARD, CIRCLE 39

FOR THAT EXTRA EDGE IN PRODUCTION!



TESTS PROVE

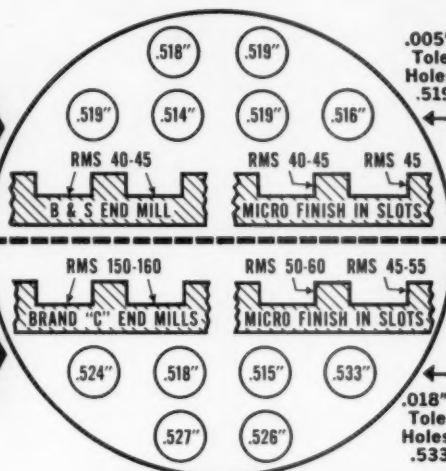
1 B&S 3-Flute End Mill Outperforms
2 Competitive Center Cutting 4-Flute End Mills in Production and Microfinish!

B&S

END
MILL

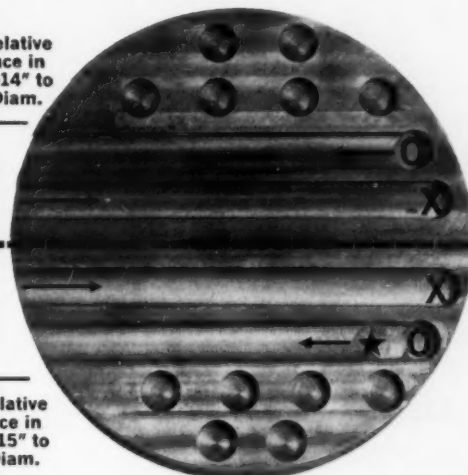
BRAND
"C"

END
MILLS



.005" Relative
Tolerance in
Holes .514" to
.519" Diam.

.018" Relative
Tolerance in
Holes .515" to
.533" Diam.





MATERIAL: AISI D3, High Carbon, High Chrome Steel.

TEST: Six 1/4" plunge cuts, each with 1/2" end mill—then plunge at 0 and cut two 1/4" deep slots ending at X—with each type end mill.

NOTE: End mill "C" failed at ★ and was replaced with new tool.

TEST TABULATION

	TYPE OF CUTTER	OPERATION	RPM IN CUT	SFM	CHIP PER TOOTH	TABLE FEED	LENGTH CUT	REMARKS
	1/2" Brown & Sharpe 3 FLUTE, CENTER CUTTING, HIGH SPEED END MILL R. H. CUT R. H. HELIX	PLUNGE CUT 6 HOLES, 1/4" DEEP	325	43	—	—	—	HOLES RANGED FROM .514 TO .519—VARIATION .005"
		PLUNGE AND SLOT	325	43	.00168	1 1/4"*	5 1/4"	COMPLETED SLOT WITHOUT HEATING, CHATTER
		CUT SECOND SLOT	325	43	.00168	1 1/4"*	5 1/4"	STOP FEED. REMOVE END MILL —WEAR LAND .004"
		*THIS TEST WAS ALSO RUN AT 2" TABLE FEED. SAME RPM NO APPRECIABLE CHANGE IN RESULTS						
	1/2" BRAND "C" 4 FLUTE, CENTER CUTTING, HIGH SPEED END MILL R. H. CUT R. H. HELIX	PLUNGE CUT 6 HOLES, 1/4" DEEP	325	43	—	—	—	HOLES RANGED FROM .515 TO .533—VARIATION .018"
		PLUNGE AND SLOT	325	43	.0015	2"	3/4"	FIRST END MILL FAILED— CUTTING POINT .010" WEAR
		CONTINUE ABOVE SLOT NEW END MILL	325	43	.0015	2"	4 1/4"	NEW END MILL CUTS WITH EXCESSIVE CHATTER— CHIPS CLOG
		CUT SECOND SLOT	325	43	.0015	2"	5 1/4"	STOP FEED. REMOVE END MILL —WEAR LAND .020" ON SECOND BRAND "C" END MILL

The above test points up two important facts that can benefit all end mill users.

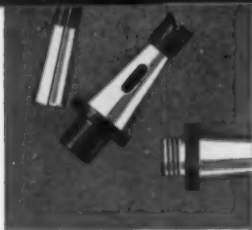
First, a three flute, B&S center cutting end mill gives greater chip clearance in confined cuts thereby eliminating chatter, overheating and excessive tool wear.

Second, Brown & Sharpe cutting tool engineering offers tooling superiority, better finish, greater production and resulting profit improvement.

There are 1065 different "standard", off-the-shelf, B&S end mills to choose from. End wonder, worry and wait—call your B&S Distributor now.

Brown & Sharpe
HIGH SPEED STEEL CUTTING TOOLS
USE READER SERVICE CARD, CIRCLE 40

NELCO
CARBIDE CUTTING TOOLS



TO HELP YOU GET MORE FROM MACHINE TOOLS

Free New Catalog from your distributor makes it easier to order Brown & Sharpe Machine Shop Accessories

Brand new B&S Machine Shop Accessories Catalog 37A tells all you want to know . . . easier . . . faster.

You get complete information on Arbors — Adapters — Collets — Sleeves — Ground Flat Stock — Index Plates — Permanent Magnet Chucks — Taper Mandrels and Expansion Bushings — Vises — Work Driving Dogs . . .

You find what you want . . . FAST, by referring to the handy Brown & Sharpe "Pictorial Index" that shows page numbers next to pictures of each item. And you read faster because all the information for each item is printed in one spot.

Most important . . . you order the finest machine shop accessories in the world! Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.



Brown & Sharpe  **PRECISION CENTER**

USE READER SERVICE CARD, CIRCLE 41

HERE'S BIG NEWS IN POWER SAWING



TWO NEW MODELS with 20 NEW FEATURES for Easier, More Productive Cut-off Sawing

Already the world's fastest automatic cut-off saw, now made even better! Some of these new features are:

NEW CONTROL CONSOLE—Human Engineering design for operation from left or right position. All operating controls grouped for natural sequence of operation.

NEW SELF ADJUSTING TOOL GUIDES—completely eliminates tedious adjustment for exact band support. Hairline accuracy maintained by means of spring loaded insert type guides. The carbide back-up with double ball bearings are built for heavy-duty life.

NEW JOB SELECTOR—a famous DoALL feature, now adapted for cut-off work. Guesswork eliminated for over 200 frequently used materials. Indicates correct speed, band type, coolant and anticipated sawing rate.

NEW SPEED INDICATOR—electronic tachometer permits more accurate setting and continuous monitoring of blade speed.

NEW FEED INDICATOR—suppressed type gage amplifies needle swing within sawing range for easier feed control and accurate repeat settings.

NEW WORK HEIGHT SELECTOR—(optional) eliminates wasted cutting head over-travel. Simply set control to size and head automatically rises just enough to clear workpiece. Dial control eliminates operator adjustments.

These and many other functional features are incorporated in the completely new, fully automatic Model C-68 and manual Model C-67 Power Saws.

PS-13

Demon[®] SAW BLADES HIGH SPEED STEEL

CUT SAWING COSTS . . . SAVE MATERIAL

The new C-67 and C-68 Power Saws are designed for maximum production and blade life using Demon High-Speed Steel Saw Bands. These bands cut up to ten times faster and last 30 times longer than carbon steel. And being only $\frac{1}{16}$ " thick, kerf material waste is minimized on each and every cut.

Free Power Saw Demonstration

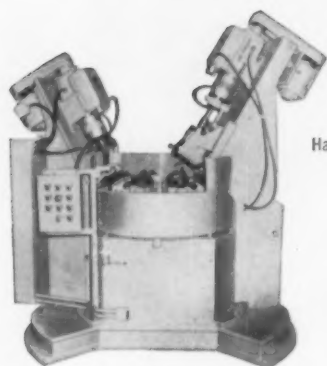
Call your local DoALL store for a free "in-your-plant" demonstration —on your own materials and cut-off problems. Get your copy of the new Power Saw Bulletin describing the new DoALL C-67 and C-68 Power Saws.



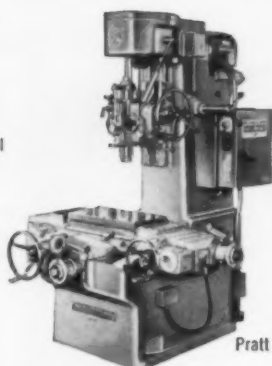
THIS IS A
TYPICAL DoALL STORE

The DoALL Company, Des Plaines, Illinois

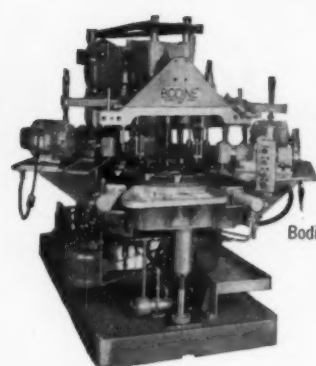




Hartford Special



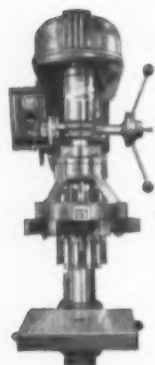
Pratt & Whitney



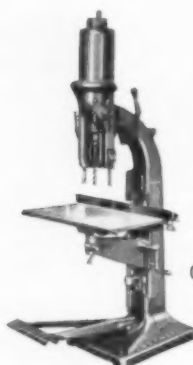
Bodine

18 LEADERS

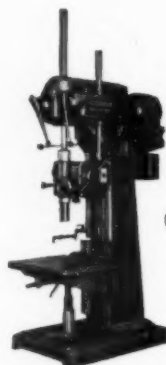
stake their reputations on



U. S. Drill Head



Greenlee



Cleereman



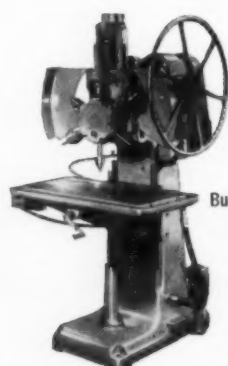
Moore



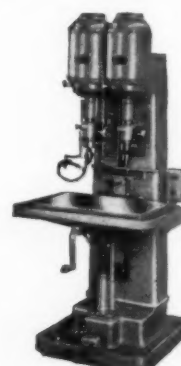
Dumore



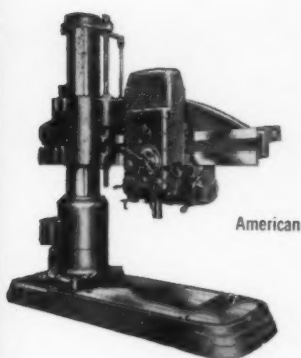
Snow



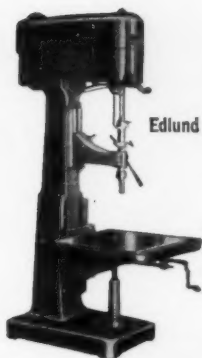
Burg



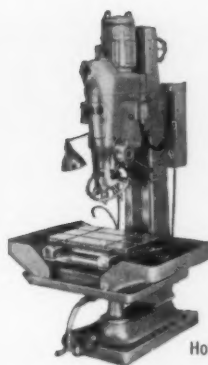
Leland-Gifford



American



Edlund



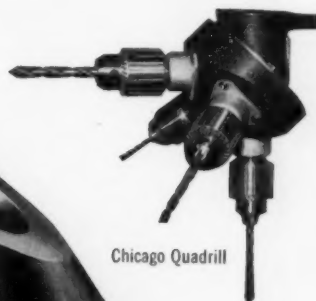
Howe & Fant



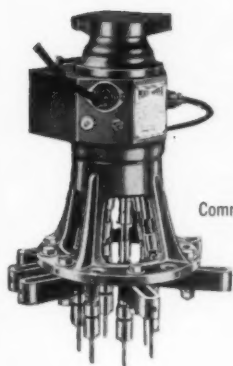
Fosdick

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CHUCKS



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Your industrial supply distributor makes it his business to know your business. He is always available and ready to fill your needs quickly, dependably and economically. When you need chucks, you can depend upon Jacobs and the Jacobs industrial supply distributor who works with you . . . your partner in progress through service.



THE JACOBS MANUFACTURING COMPANY, WEST HARTFORD, CONNECTICUT



30% TO 50% LONGER LIFE FOR RESINOID-BONDED DIAMOND WHEELS

Six hundred separate trials, using 145 wheels, were run by the Diamond Research Laboratory to test a completely new type of natural diamond grit for resinoid wheels. The results: this new grit increases the life of natural diamond resinoid-bonded wheels by 30% to 50%.

The particles of this new grit do not readily pull out of the bond. Instead, they break down into ever-finer fragments which constantly expose new, sharp cutting surfaces.

TEST EQUIPMENT: Three 18" Jones & Shipman production grinders were fitted with special spindles to enable wheels to operate at 5500 surface feet per minute, the speed generally used in diamond grinding.

The wheels were of the D1A1 type, 6" in diameter, 3/16" face width, with 1/8" depth of resin. Each wheel contained 31 1/4 carats of the new grit. Metal to be ground was tungsten carbide of the same quality normally used for milling cutters, lathe tools, etc. During the course of the tests, 700 pounds of hardest carbide were ground away.

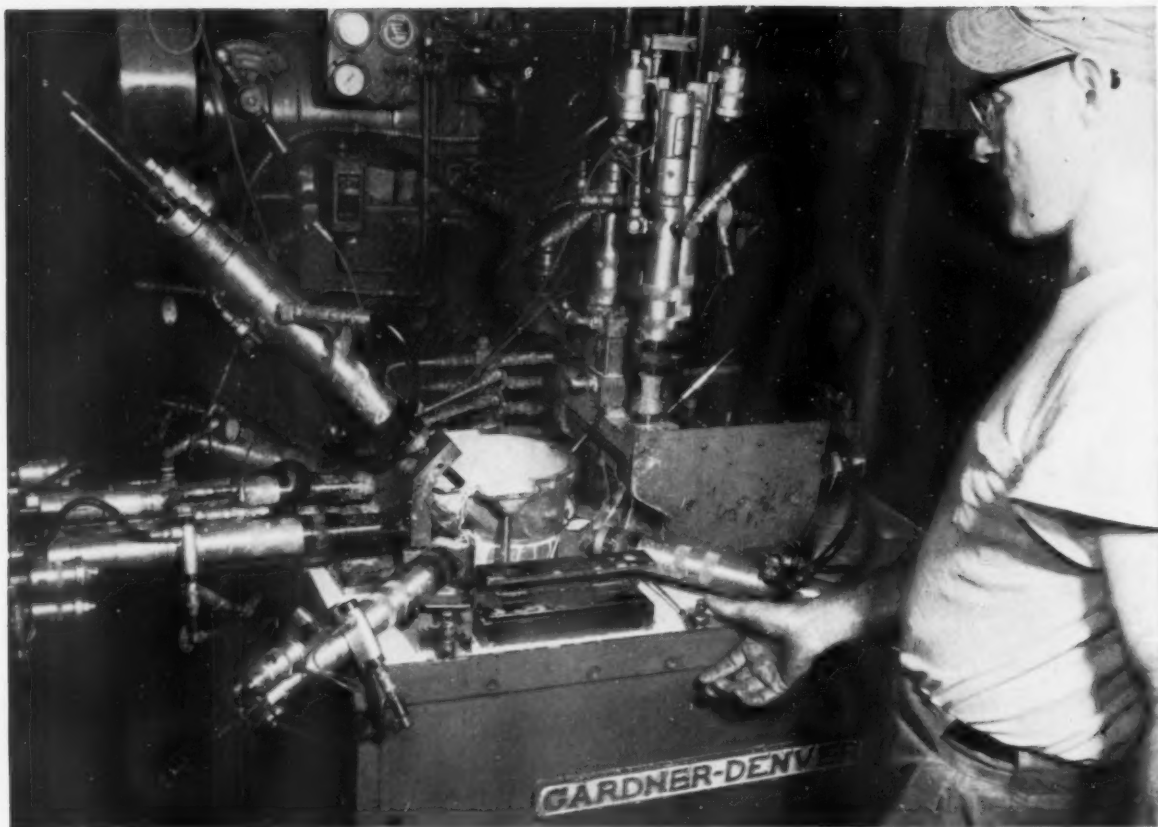
RESULTS: This new friable grit, Selected Natural Diamond (SND-RESINOID), increases the life of natural diamond resinoid wheels by 30% to 50%, depending on the type of job at hand. The grit will be available to your wheel manufacturer soon. Next time you order diamond resinoid wheels, specify SND-RESINOID... the most economical and the most efficient grit you can use.



INDUSTRIAL DISTRIBUTORS (SALES), LTD.

YOU CAN DEPEND ON NATURAL DIAMONDS

Tests were run on these three Jones & Shipman production grinders. Results showed that the new grit, Selected Natural Diamond (SND-RESINOID), increases the life span of natural diamond resinoid wheels by 30% to 50%.



Time study clocks multiple drilling operation at 254 pieces per hour

15 HOLES DRILLED IN VACUUM CLEANER MOTOR BASE IN LESS THAN 15 SECONDS

Problem: To speed drilling of fifteen .120"-diameter holes in the motor base of a vacuum cleaner at Eureka-Williams Corporation plant in Bloomington, Illinois.

Solution: A specially designed Gardner-Denver multiple drilling machine. Ten drills, standard Model 92-2P "Airfeedrills"®, are permanently mounted on the fixture. Five "Airfeedrills" are vertically mounted on a reciprocating slide to facilitate loading and unloading the part.

How it works: Operator places the part in the fix-

ture, then activates the following cycle: Two air clamps automatically hold the part in position. Then ten drills automatically start drilling, as the reciprocating slide moves into position and drills the remaining five holes. The operator then presses a release button which returns the reciprocating slide and deactivates the air clamps, leaving the part free for removal.

Cost-cutting results: A recent time study clocked this unique drilling operation at 254 pieces per hour—or a part processed in approximately 15 seconds. This is a typical example of special machines designed and built by Gardner-Denver to solve tough production problems. For complete information, contact your Gardner-Denver representative.



EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER - DENVER

Gardner-Denver Company, Quincy, Illinois

In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

a new mark



for first quality established in 1910

We have adopted a brand-new trademark, and we hope you like it! • Some of us found it hard to give up our well known tool-in-hand design, which had served faithfully for decades as the insigne of First Quality in tool steel. But times change, and a tool bit no longer represents us. • Our new trademark is for Vanadium-Alloys Steel Company's continually widening range of fine steels—for tools, dies, ultra-high strength structural applications and many other uses. We trust you'll come to know this new mark well, as the sign of "the best obtainable" in the most highly developed steels of our time.



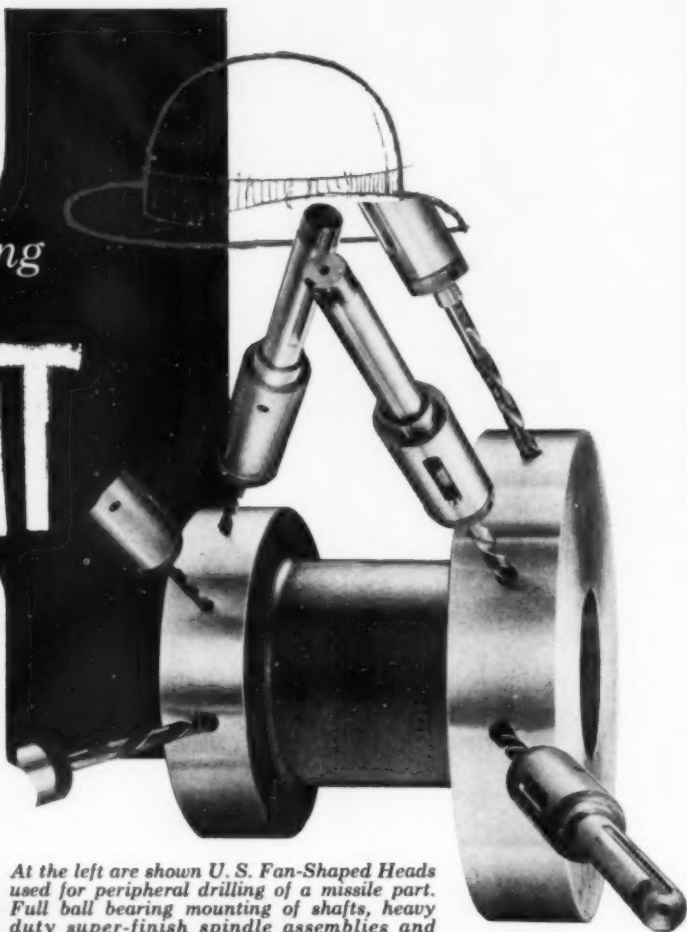
Vanadium-Alloys Steel Company
LATROBE, PENNSYLVANIA

DIVISIONS: Anchor Drawn Steel Co. • Colonial Steel Co. • Metal Forming Corporation • Pittsburgh Tool Steel Wire Co.
SUBSIDIARIES: Vanadium-Alloys Steel Canada Limited • Vanadium-Alloys Steel Societa Italiana Per Azioni • EUROPEAN
ASSOCIATES: Societe Commentryenne Des Aciers Fins Vanadium-Alloys (France) • Nazionale Cogne Societa Italiana (Italy)

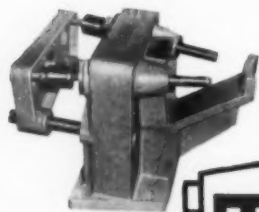
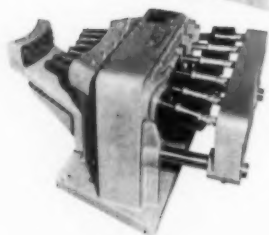
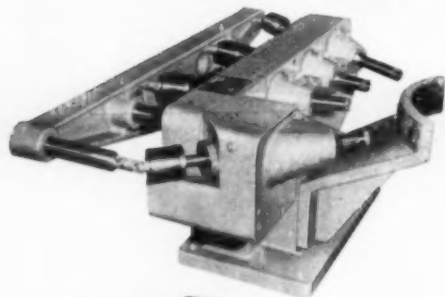
Peripheral Drilling
(even in missile parts)

is
OLD HAT

to
**U. S. Drill Head
Engineers!**



At the left are shown U. S. Fan-Shaped Heads used for peripheral drilling of a missile part. Full ball bearing mounting of shafts, heavy duty super-finish spindle assemblies and shaved gears throughout assure quiet, trouble-free performance . . . full torque and maintained drilling precision.



Maybe your PERIPHERAL DRILLING jobs aren't exactly like this, but U. S. Drill Head engineers can show you the cost-reducing way to do them. They did it for a missile manufacturer on a part that involved the same problems . . . and the profit-making setup included the U. S. Fan-Shaped Heads shown here.

This is "old hat" for U. S. Heads in automotive parts, diesel engines and many other industries, too. And now, with the space age continually bringing new products — new manufacturing problems — it will pay you to take advantage of U. S. Drill Head Co.'s leadership in applying cost-reducing multiple drilling and tapping heads.

Ask for recommendations on your particular drilling problems.



Adjustable and Fixed Center Multiple Drilling Heads.
Individual Lead Screw Multiple Tapping Heads.

UNITED STATES DRILL HEAD CO.

BURNS STREET • CINCINNATI 4, OHIO

From HANNIFIN...
unit construction
to give you air valves
that do more jobs



Hannifin 1/4" four-way valve with "universal" base and new Speed Control section. Single-solenoid actuated, 10 other actuators available.



Hannifin's exclusive "spool-poppet" seals bushing-tight at either end of its short stroke.



For complete I.I.C. compliance, valve is electrically inoperative until dust-tight, splashproof solenoid cover is replaced and fastened tightly. Result: no more clogged, jammed solenoids.

One of the versatile—and most popular—Hannifin air control valves is this "CC" series, single-solenoid model. It is available for either 1/4" or 3/8" air lines and is gasket-mounted to its own base. This particular base (one of three choices offered) can either be O-ring gasketed to your manifold or mounted over an opening in your bracket or machine. It will receive all four lines from below or take the inlet line from below and the two cylinder lines out one side. Or, you can make all connections at the sides.

When it comes to actuation, Hannifin offers an even wider selection: hand, foot, cam, pressure, single or double solenoid.

When necessary, you can remove this entire valve from its base without disconnecting air lines. Or, the exclusive "spool-poppet" can be replaced without even breaking electrical connections.

The "CC" series, like all Hannifin valves, is designed with "full flow" internal passages as large or larger than its rated pipe size.

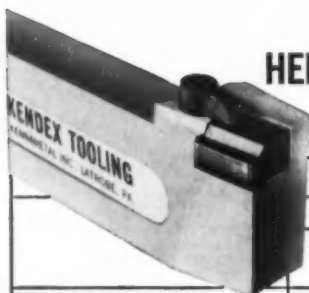
You will find these and most other Hannifin valves described in Hannifin's new "Valve Finder." Get your copy from your Hannifin man, listed in the A-Z volume of Thomas' Register, or write:

HANNIFIN COMPANY

525 South Wolf Road • Des Plaines, Illinois



DON'T WASTE DOLLARS IN MACHINE OUTPUT TO SAVE PENNIES IN TOOL LIFE



HERE'S HOW SOME SHOPS HAVE DOUBLED AND TRIPLED
THE OUTPUT OF EXPENSIVE MACHINES

Typical Examples—Same Machines . . . Same Tools . . . Same Workpieces

	Job No. 1		Job No. 2		Job No. 3		Job No. 4	
	240-Minute Tool Life Setup	25-Minute Tool Life Setup	75-Minute Tool Life Setup	25-Minute Tool Life Setup	120-Minute Tool Life Setup	80-Minute Tool Life Setup	120-Minute Tool Life Setup	22-Minute Tool Life Setup
Machine Cost per Hour	\$ 8.00	\$ 8.00	\$10.00	\$10.00	\$ 9.00	\$ 9.00	\$ 9.00	\$ 9.00
Tool Cost per Hour	\$.04	\$.40	\$.36	\$.76	\$.14	\$.215	\$.14	\$.77
Cost per 8-Hour Shift	\$64.32	\$67.20	\$82.88	\$86.08	\$73.12	\$73.72	\$73.12	\$78.16
Pieces per Shift	51	181	8	17	94 hrs./pc.	41 hrs./pc.	8	16
Cost per Piece	\$ 1.26	\$.37	\$10.36	\$ 5.06	\$89.16	\$377.81	\$ 9.14	\$ 4.88
Cost Reduction	70%		51%		56%		47%	

Get the complete story . . . send for the booklet "There's Profit in Retiring a Tradition."

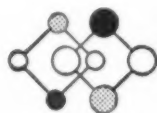
From many machine shops the story is the same—they are sacrificing low-cost carbide inserts through increased feeds and speeds . . . to achieve startling savings in total-cost-per-piece. Production increases even greater than 100% have been recorded. The increased tool costs were insignificant by comparison.

Where machines have been operating at less than maximum efficiency, unit cost can be reduced on many jobs overnight . . . merely by using modern cutting tools to get full potential machine output . . . instead of operating at fractional machine capacity to gain long tool life.

This idea has been *PROVEN-IN-USE* by many progressive plants. We will gladly send you records of such operations. These results can be duplicated in plants where machines and talented operators have been held back by old ideas about tooling and tooling costs. Ask your Kennametal Carbide Engineer how Kendex* (patented) tooling can help you get more efficient output from your machines . . . or write KENNAMETAL INC., Latrobe, Pennsylvania, for the booklet "There's Profit in Retiring a Tradition."

*Trademark

9-7229



INDUSTRY AND
KENNAMETAL
...Partners in Progress

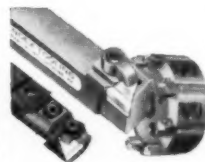
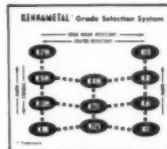
USE READER SERVICE CARD, CIRCLE 49

TO MULTIPLY YOUR MACHINE OUTPUT ...YOU NEED 3 THINGS:



The 'Three-Man Tooling Team'
that utilizes the specialized knowledge of your Tool Engineer, your Machine Operator, and the Kennametal Carbide Engineer . . . to get the right tooling on every job.

The Kennametal complete range of grades that provides the precise properties and uniformity that permits accurate prediction of tool life.



Kendex Instant Insert
change without need to reposition the tool. This is the key to this new practice . . . frequent tool change without excessive down-time.

7 Lapmaster® Job Lapping CENTERS

**Conveniently Located
to Handle Your
Lapping Requirements**



Flatness to .000011" . . .
Finish to 2 micro inches in
small lots . . . or production runs.

Fast, dependable deliveries to meet any production schedule.

Wide range of shapes and sizes . . . any metal, ceramics or plastic material . . . can be handled.

Rigid inspection and quality control assures flatness and finish to your exact specifications.

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6626 Supply Row
Houston 11, Texas
Tel.: Walnut 3-7683

CHICAGO
6400 Oakton Street
Morton Grove, Illinois
Tel.: Orchard 4-0100

VANDALIA, ILLINOIS
Keefer at Jefferson
Vandalia, Illinois
Tel.: 1450

NEW YORK
185 South Newman Street
Hackensack, New Jersey
Tel.: Hubbard 7-3212

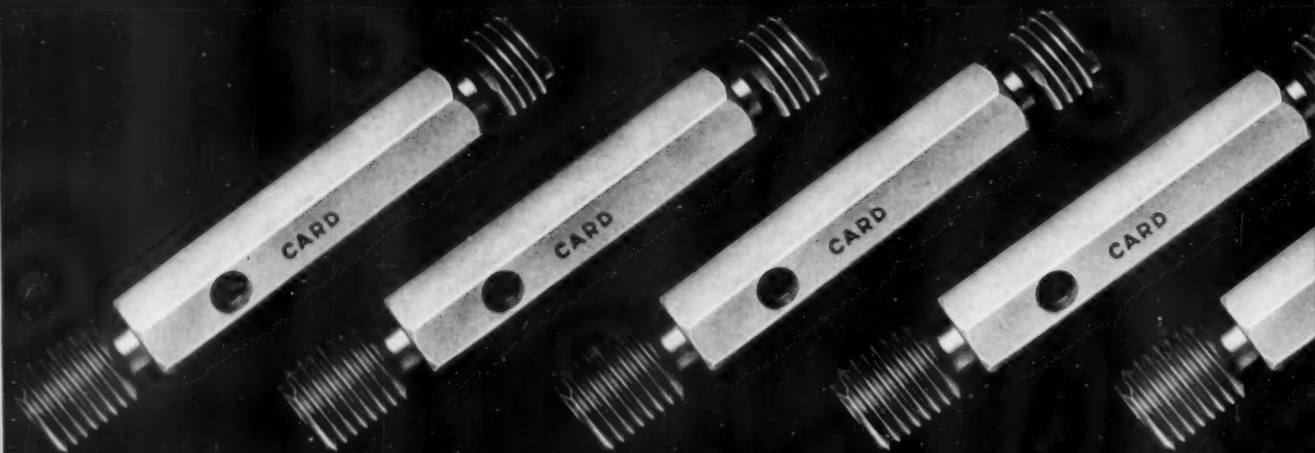
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617 Parkdale Ave., North
Hamilton, Ontario, Canada
Tel.: Liberty 4-3358

Lapmaster®
LAPPING CENTERS

◆ **CRANE PACKING COMPANY**
6469 Oakton Street, Morton Grove, Illinois (Chicago Suburb)
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When you see uniformity, remember...



With Card gages you get uniformity

Your production's consistent ...because Card gages are uniform

... And they incorporate the finest quality materials and craftsmanship. These gages are produced from top quality steels by today's most advanced manufacturing methods. At every stage of production they're under the watchful eyes of men with years of metalworking experience. The result of this quality control is unvarying precision in every gage pro-

duced. Let a Card technical man show you exactly how this uniform high precision will pay off in your plant.

S. W. CARD DIVISION,
Mansfield, Mass. Card Ware-
houses: Atlanta, Chicago, Detroit,
Fort Worth, Los Angeles, New
York, San Francisco.



CARD

DIVISION OF UNION TWIST DRILL COMPANY

— *Serving you through the best distributors from Coast to Coast*

USE READER SERVICE CARD, CIRCLE 51

If you use carbide milling cutters as much as automobiles use fasteners...



Ordering Union carbide milling cutters will cut your production time and costs



*The more you use carbide milling cutters
the more you need Union*

Union carbide milling cutters are typical of Union progress — in carbide tool development and in increasing the variety and versatility of milling cutter types. In plants throughout the country Union technical men have proved that the time and costs of many production operations can be reduced with Union carbide milling cutters and other Union carbide tools,

as well as Union drills, end mills, reamers, hobs, inserted blade cutters, gear cutters and milling cutters.

Available nationally through Union Distributors

and stocked in Union warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City and San Francisco.



UNION

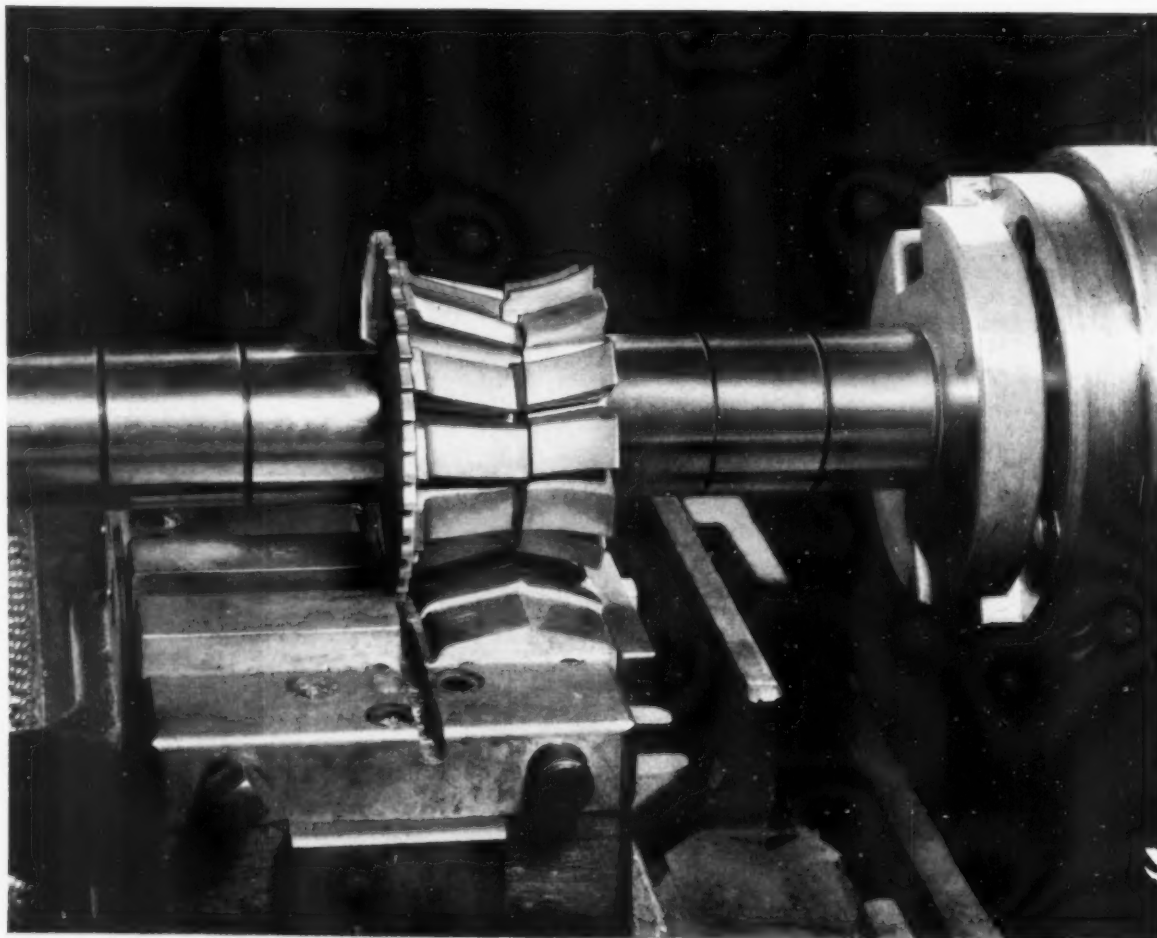
TWIST DRILL COMPANY, Athol, Massachusetts

S. W. CARD DIVISION, Mansfield, Mass.; BUTTERFIELD DIVISION, Derby Line, Vt.

USE READER SERVICE CARD, CIRCLE 52

Mill Odd Shapes in One Operation

...with Barber-Colman Form-Relieved Cutters



Milling is the best way to produce accurate, irregular forms with a minimum of tooling expense. But, when you get down to cases, much depends on the design and quality of the milling cutter used.

Barber-Colman Company will manufacture a cutter from your part or print for almost any form. In it will be designed all the factors needed to upgrade production efficiency and work quality.

Take this small part, for example. As shown on the drawing, there are two opposed surfaces that require machining at right angles to the cutter axis. For efficient milling at these points, the teeth must have both left-hand and right-hand axial relief. This design problem was solved by making the tool interlocking, with axial relief in both directions. Right-hand and left-hand helical flutes assure smooth cutting action and fine finish.

The cutters are *unground*. Yet, all dimensions are held to a maximum tolerance of $\pm .002$ in. Angular surfaces are held to ± 30 minutes. A separate cutoff operation was eliminated by ganging a metal-slitting saw with the form cutters.

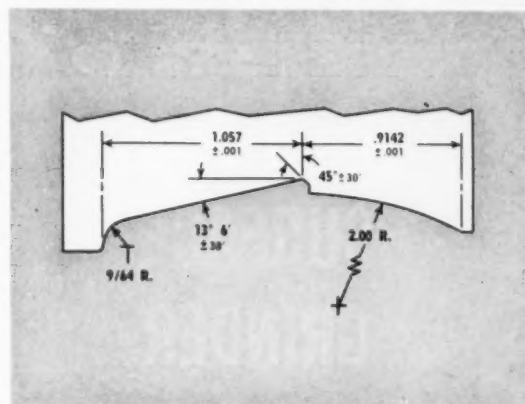
Thus, fine finish and high accuracy were provided at the lowest possible cost and with a minimum tooling expense.

Five types of engineering ...

These Barber-Colman engineering and manufacturing capabilities can be added to your own in finding better solutions to milling problems:

1. *Application engineering* — on-the-spot evaluation of milling problems by experienced tool designers.
2. *Design engineering* — highly specialized tool engineering, backed by electronic computers for fast, accurate calculation of complex tooth forms.
3. *Metallurgical engineering* — specially selected steels and heat treatment for your particular material and tool geometry.
4. *Manufacturing* — the most complete and advanced processes under one roof for producing exactly the right finish, highest accuracy, and any cutter style.
5. *Quality control* — optical master inspection, seven different control stations, and numerous separate inspections for individual cutters.

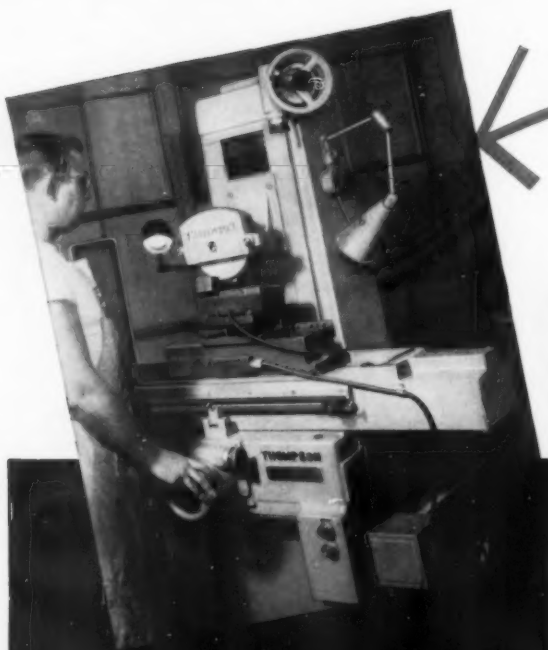
If you are producing irregular parts by shaping, crush grinding, or milling, it will pay you to let a Barber-Colman milling cutter engineer look at the job. He will show you how to combine the maximum number of operations in a single cut with lowest possible tool cost. Call your Barber-Colman sales office or Rockford — TR - 7-5741.



Barber-Colman Company



93 Loomis Street, Rockford, Illinois



NEW TYPE D Hand Feed SURFACE GRINDER

is ruggedly designed
for precision work.

With men like Mr. Vogt, who rate tool room grinders solely on their performance, Thompson's new Type D machine is winning enthusiastic approval.

Send for descriptive literature on this new Type D machine and compare the advantages it offers you in cost-cutting time-saving and trouble-free performance. Immediate delivery is available.

THE THOMPSON GRINDER CO.

SPRINGFIELD, OHIO

*Completely Satisfactory
in Every Way*

... says Mr. William H. Vogt, Division Superintendent of Parts and Tool Manufacturing at Taylor Instrument Companies, Rochester, N. Y.



OFFICES IN ALL PRINCIPAL CITIES		Taylor Instrument Companies	
<small>By the Home TEMPERATURE & WEATHER INSTRUMENTS</small>		<small>By Industry TEMPERATURE PRESSURE HUMIDITY FLOW & LIQUID LEVEL INSTRUMENTS</small>	
<small>SUBSIDIARIES IN TORONTO, CANADA LONDON, ENGLAND MELBOURNE, AUSTRALIA</small>		<small>85 ADELS STREET ROCHESTER, N. Y. U.S.A. May 7, 1959</small>	
<p>Mr. John C. Wilson, Vice-President, Sales & Engineering The Thompson Grinder Company Springfield, Ohio</p>			
<p>Subject: THOMPSON Type D Surface Grinder</p>			
<p>Dear John:</p>			
<p>We have proven the new Thompson Type D Tool Room Grinder by rigid tests in our Tool Grinding Department. We find it completely satisfactory in every way.</p>			
<p>We find these decided advantages on the new Thompson:</p>			
<ol style="list-style-type: none"> 1. Its ease of adjustment 2. Its ruggedness and rigidity 3. Its bedway and column protection 4. Its large vertical capacity 5. Its cross-feed movement obtained by moving the wheel head rather than using a saddle, which permits accurate grinding of slots. 			
<p>Everything considered, we find, in our work, the new Thompson Type D a very superior precision machine.</p>			
<p>Yours very truly,</p>			
<p><i>William H. Vogt</i></p>			
<p>whv:lb</p>		<p>William H. Vogt Division Superintendent Parts and Tool Manufacturing</p>	



MEET MRS. PETER PEFF

...and her company's new lightweight
liquid-oxygen "vacuum bottle" for jet planes



Mrs. Peff, president, Superior Air Products, Newark, N. J., with Supairco's recently developed liquid-oxygen "vacuum bottle."

MANY a tough problem has been solved by Mrs. Peff and her company since 1952, when she assumed the presidency after her husband's death. Specialists in building low-temperature apparatus and complete plants to produce oxygen and other gases, "Supairco" was asked recently to develop a light, compact container to supply oxygen for aircraft crews at high altitudes.

Ingenious design utilizing the broad and varied properties available in copper and its alloys produced the "vacuum bottle" shown above. The inner sphere is of Everdur®, Anaconda copper-silicon alloy, which has the workability and resistance to corrosion needed—and, more important, the strength and toughness to make possible a relatively thin, light shell that can withstand vibration and fatigue stresses aloft—plus shocks from catapult launchings and carrier landings. The outer shell is of Anaconda copper, highly polished to reflect heat. This, plus a vacuum under .001 microns between the spheres, holds liquid oxygen at -297 F.

Starting with over 100 standard copper alloys, Anaconda can provide an almost unlimited number of combinations of useful properties. When new and unusual problems arise, use Anaconda technical specialists to help you select metals for your needs. Address the American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 1941



LEFT: Inside the copper shell in main illustration is this slightly smaller liquid-oxygen container made of Everdur, the metal that spins and machines readily, is easy to join by soldering, brazing, welding. **RIGHT:** Completed liquid-oxygen converter, built by Mine Safety Appliances Company, Pittsburgh, Pa., serves 8-man crew. It is one-third the weight of the cylinder it replaces, takes much less space.

ANACONDA®

**COPPER • BRASS • BRONZE
NICKEL SILVER MILL PRODUCTS**
Made by The American Brass Company

HARDINGE
ELMIRA, N.Y.

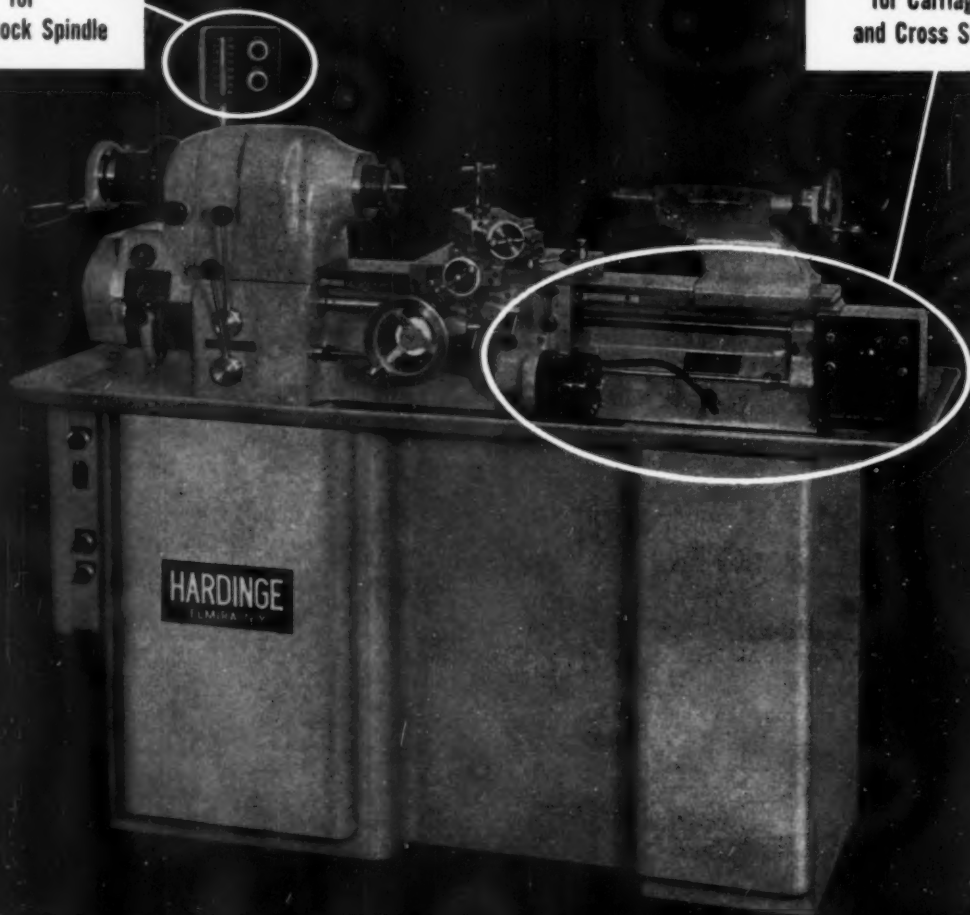
Tool Room and Production Lathe

Features

Infinite Control of Speed and Feed

Variable Speed Drive
for
Headstock Spindle

Variable Feed Drive
for Carriage
and Cross Slide



RIGIDLY BUILT TO TAKE ADVANTAGE OF
CARBIDE CUTTING TOOLS AT HIGH SPEEDS.

Both drives are independent and
infinitely variable to secure every
possible combination of speeds and feeds.

Write HARDINGE for Bulletin HLV

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

OFFICES IN PRINCIPAL CITIES. Export Office: 269 Lafayette Street, New York, N. Y.

...they all
prefer **PRODUCTO**
die sets

DIE MAKERS

like the amazing speed and ease of "take-apart and put-together" made possible by Qwik-Fit Guide Pins. (Safer handling, too.)

DIE DESIGNERS

appreciate the unlimited selection of die sets which accommodate any type of die design.

PRESSROOM FOREMEN

are convinced that Producto die sets maintain accuracy through long runs, keep production up, downtime down.

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have found consistent die set accuracy, dependable delivery, and smooth performance justifies the confidence with which they specify Producto.

Quick, jam-free assembly and disassembly, lasting accuracy, unlimited selection of sizes and styles! Add to these advantages the benefits of immediate service in every industrial center through Producto's growing network of 46 branch assembly plants and distributor warehouses...and you realize why "They all prefer Producto". • **A WEALTH OF DIE SET INFORMATION** is available to you, free, in the comprehensive, easy-to-use Producto Catalog No. 11, and in regular issues of *Die Set Digest*. Write today for these valuable aids.



THE PRODUCTO MACHINE COMPANY
925 Housatonic Avenue, Bridgeport 1, Connecticut

PRODUCTO

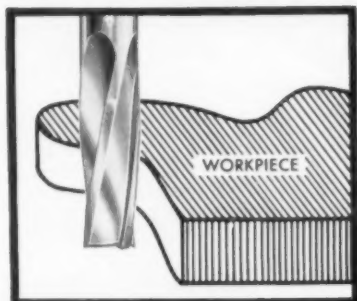
PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS



Precision Ground SOLID CARBIDE TOOLS AND BURS

Job Applications

BETTER PROFILE MILLING ON 302 STAINLESS WITH 4-FLUTE, SLOW SPIRAL SOLID CARBIDE END MILL



After failure of H.S.S. End Mill, a Series 1505, 5/16" diameter "standard stock" Atrax Carbide End Mill was used. Operation performed on a Bridgeport with hand feed. Stock removal between .025"-.030" on roughing cut and between .005"-.006" on finish cut, both with same tool. Speed-2750 R.P.M.

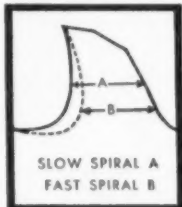
SPECIFIC ADVANTAGES

of using this slow spiral, (approximately 15° right hand helix) Solid Carbide End Mill is the strengthened tooth form and reduced rake angle, not obtained with the regular fast spiral.

This Tool is designed and recommended especially for use on stainless steel and other

TOUGH TO MACHINE MATERIALS

stellite, titanium, nickel, chrome, monel metal and high temperature steels. Another decided advantage—this Atrax Tool can be run at slower speeds for longer tool life without injury to cutting edge.



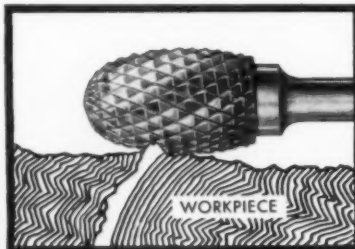
WHY USE A DIAMOND CUT BUR?

A diamond cut pattern which can be applied to a coarse, standard, or fine cut Bur is beneficial in the elimination of elongated slivers usually obtained when deburring such materials as stainless steel. In addition, the diamond cut provides greater operator control when used on hard materials, dies, molds, etc. and provides longer tool life on recommended applications.

NOTE: Speeds used with Diamond Cut Burs should be reduced by 1/3 to 1/2 the speeds of regular cut Burs.

HOW AN ATRAX E-161 BUR WITH DIAMOND CUT WAS USED

Hand operated at 8000 to 12000 R.P.M., using a portable air grinder, an Atrax Oval Type Bur was used to



remove flashing from nodular iron castings.

Previously a H.S.S. Bur had been used with a tool life of 8 hours. The Atrax E-161 was removed for resharpener after 48 operating hours.

COSTS LESS 3 WAYS

Tool cost was \$.06 per hour less with the Carbide Bur. The Carbide Bur also removed excess flashing from each casting faster with better surface finish and less operator fatigue. Atrax Oval Shape Burs are available from stock in Standard, Coarse, Fine and Chip Breaker types at no increase in cost.



WHAT IS A BUR WITH CHIP BREAKER CUT?

A chip breaker is a break in the continuity of the cutting edge which interrupts the cutting action, thereby breaking the chip into small sections and allowing improved tool control. Chip Breaker can be furnished on all Atrax Burs, on request, at no extra charge.

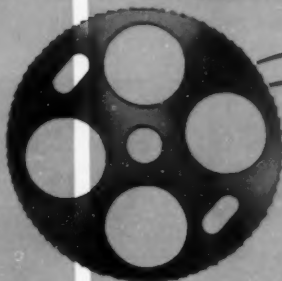


The job applications outlined here are taken from actual customer production experiences. We feel that this information can help you improve production, lower costs, and discover the superiority of Atrax Solid Carbide Tools and Burs.

SEND FOR 148 PAGE "STANDARD REFERENCE"
ON SOLID CARBIDE TOOLS...

TO: THE ATRAX COMPANY
240 DAY STREET, NEWINGTON 11, CONNECTICUT

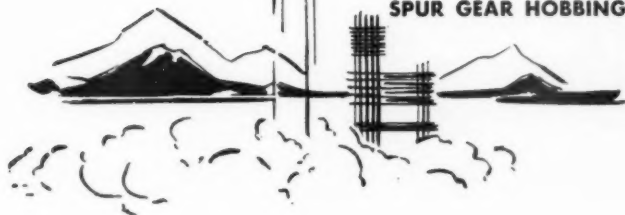




GEAR
ILLUSTRATIONS
ACTUAL SIZE



NO. 132-01 MIKRON
SPUR GEAR HOBBING MACHINE



DO YOUR GEARS
NEED TO BE
MADE TO THESE
SPECIFICATIONS ?

...then go
MIKRON



Ask for our Bulletin RH-132-01 which describes the new MIKRON 15-Second Spacing Accuracy Machine.

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

Don Chisholm solved a double problem at Split Ballbearing...

It all started with a torque tube bearing for one of the top priority missile guidance systems. Two kinds of trouble had developed during the manufacturing process and engineers at the Split Ballbearing Division of Miniature Precision Bearings, Inc., Lebanon, N. H., were in a hurry to get both of them straightened out.

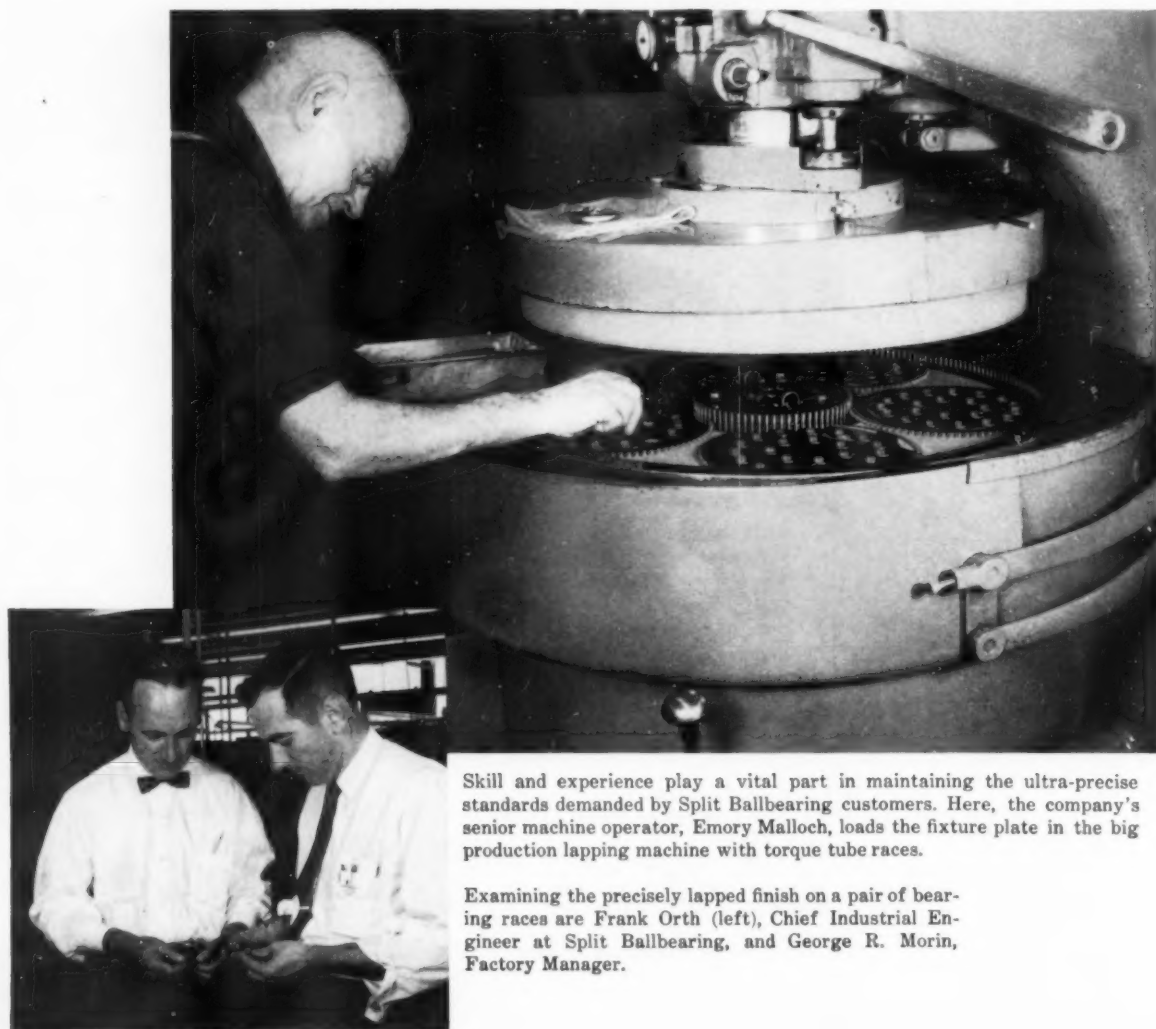
First, in bore-grinding the inner race, about .010" of stock had to be removed, but the tolerance specified was a microscopic $\pm .0001$ and an eight microinch finish was mandatory. The bore-grinding wheel used wasn't up to requirements and the reject rate was excessive.

Second, in lapping the faces of both races, the wheels used were not producing the required five microinch finish, there was an imbalance between the amount of stock removed from the upper and lower surfaces ... and, on top of that, the wheels themselves broke down

too rapidly.

Bay State was called in and Abrasive Specialist Don Chisholm attacked the problem, working closely with Distributor Harold Domingue, Abrasives & Tools, Inc., Auburn, Mass. They not only cured both troubles and brought production up to the standards required ... the people at Split Ballbearing were so delighted they asked Chisholm and Domingue to make a survey of every grinding operation in the plant. This led to fourteen other carefully considered recommendations.

Like Hal Domingue and Don Chisholm, the Bay State people in your area are trained specialists. Whether you have a single problem or a multitude of them, they're ready to apply experience, imagination and plain hard work. *Better grinding at lower cost ... that is their business.*



Skill and experience play a vital part in maintaining the ultra-precise standards demanded by Split Ballbearing customers. Here, the company's senior machine operator, Emory Malloch, loads the fixture plate in the big production lapping machine with torque tube races.

Examining the precisely lapped finish on a pair of bearing races are Frank Orth (left), Chief Industrial Engineer at Split Ballbearing, and George R. Morin, Factory Manager.

and they gave him 14 more!



Don Chisholm has built a formidable reputation for solving tricky abrasive problems. Prior to joining Bay State as an abrasive specialist, he spent 17 years as Abrasive & Tool Coordinator at General Electric's turbo-super-charger and jet engine plants where his experience was extremely varied since he had to use abrasives on unusual alloys as well as the general run of industrial metals.

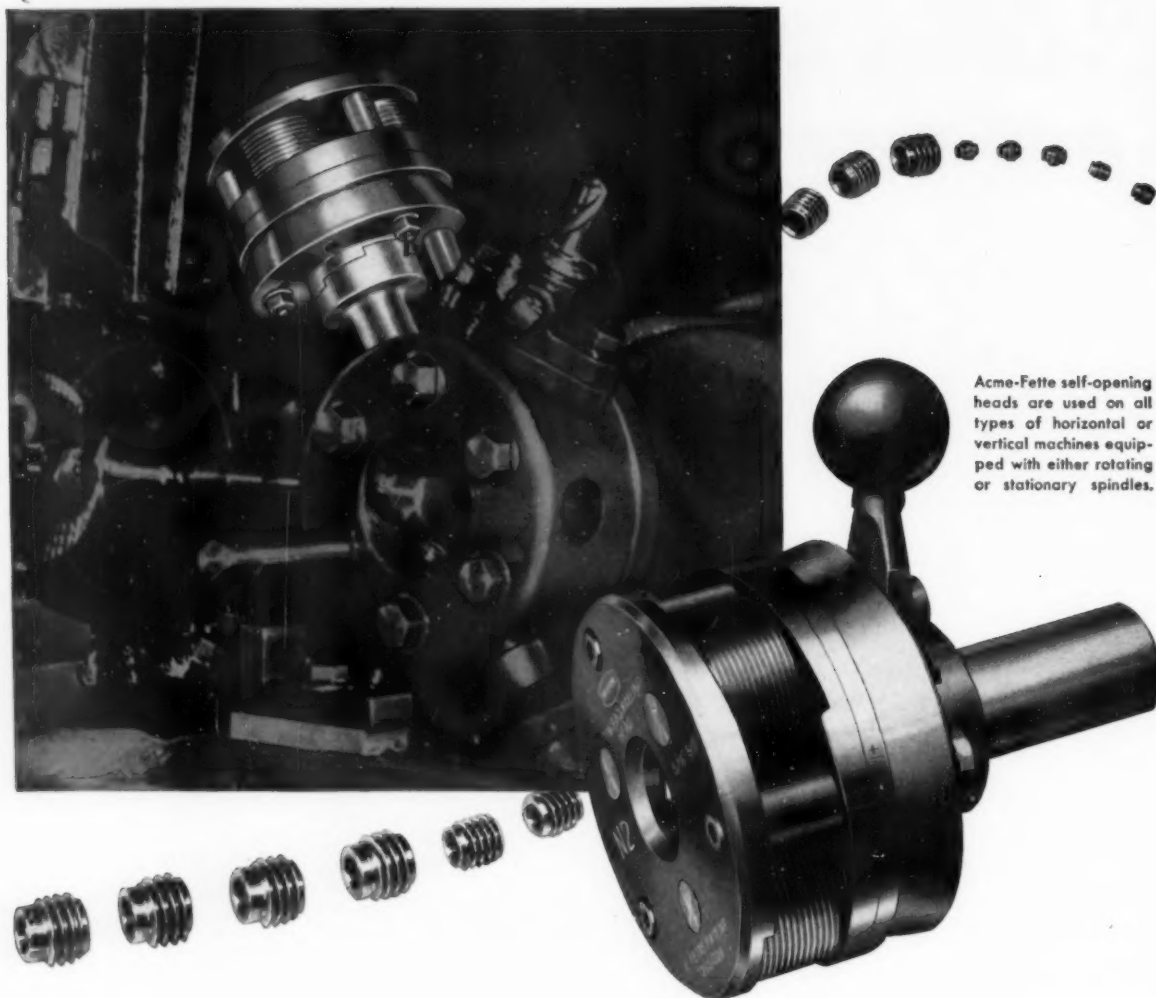
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Dear Harry:

The 40,000 members of ASTE join me in offering our congratulations to you and your staff for an outstanding achievement the *Suppliers Directory* in the June 15 issue.

The Board of Directors and Officers were enthused and optimistic over the plans and preliminary presentations observed during the building of the guide; however, it is certain that little did we expect the masterpiece that it is.

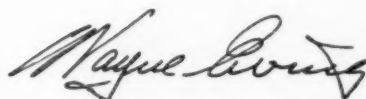
Six hundred pages of fine print pertinent to our industry, including reference to over 2500 manufacturers and 19,000 individual manufacturers' agents, could not have been easy to assemble.

John Greve, his staff and many others at headquarters have certainly "walked the extra mile" to put this, the 13th, issue to bed.

Members and other users have been requested to offer constructive suggestions for improvement to the directory. I do hope that as we use it and work with it many of our readers will comply with your invitation.

May we say again—much praise for this assist to our membership and their respective industries.

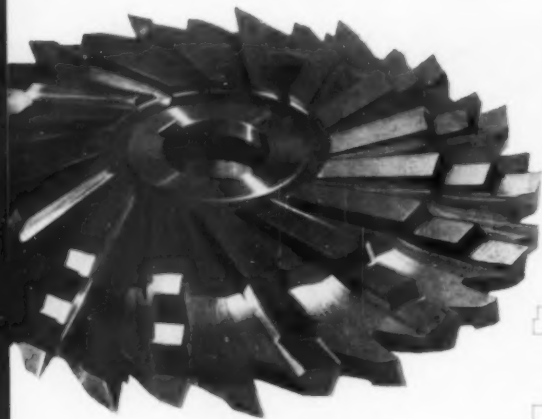
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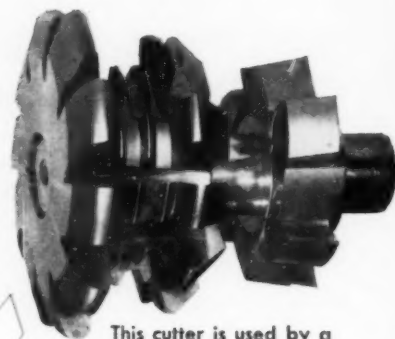
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A special multiple-step milling cutter used by steam turbine manufacturer to cut stepped rotor slots for turbine blades.



This cutter is used by a prominent saw manufacturer to form mill the profile in dado blade sets for the wood working industry.

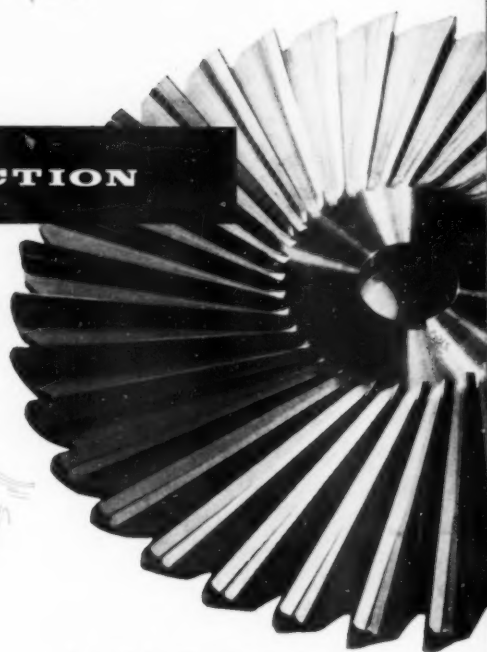
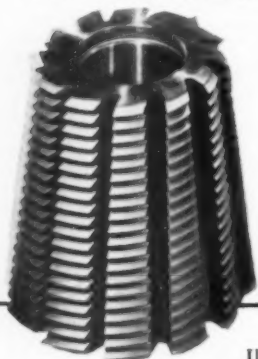


HOW TO GET THE MOST

OUT OF HIGH SPEED PRODUCTION

MILLING MACHINES

This tapered multiple thread mill cuts threads in pipe joints used in oil well drilling operations.



A special milling cutter for sweep milling impellers used in air conditioning and jet engine sections.

Illinite® Special Milling Cutters, like those shown here, speed production and cut costs two ways:

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can you afford **numerical control?**

Although numerical control has resulted in significant savings on hundreds of machining operations, it is not always a sure-fire way to cut costs. Tool engineers must analyze each operation to find out where numerical control will pay.

DURING THE PAST SEVERAL YEARS, numerical control has aroused a great deal of enthusiasm. Reports have shown such substantial and, in many cases, spectacular savings that one could easily conclude that numerical control should be applied to all machining operations and that it will always save money.

This is not necessarily the case. The answer to the question: "Can you afford numerical control?" depends on the circumstances. Each part and manufacturing operation must be individually analyzed before a decision can be made. The re-

This article is based on a talk presented to the ASTE Cleveland Chapter.

By Myron S. Curtis

Vice President-Engineering
The Warner & Swasey Co.
Cleveland, Ohio

responsibility for making this decision is in the hands of tool engineers, who take a product from design engineering and pilot it to a finished product.

Advantages: Numerical control is just one of several ways of eliminating operator control of machine tools; in other words, it makes a machine automatic. Some of its advantages are:

1. Human error is greatly reduced—hence accuracy is greater and there are fewer inspections and less scrap
2. Lead time is shorter, setup time is shorter and machine utilization is greater
3. Tool loading is correct and constant
4. It is versatile, with the ability to handle a wide range of jobs
5. Inventories of tools, jigs and templates are smaller
6. Control data can be prepared and stored in a remote location
7. Control information is easily changed.

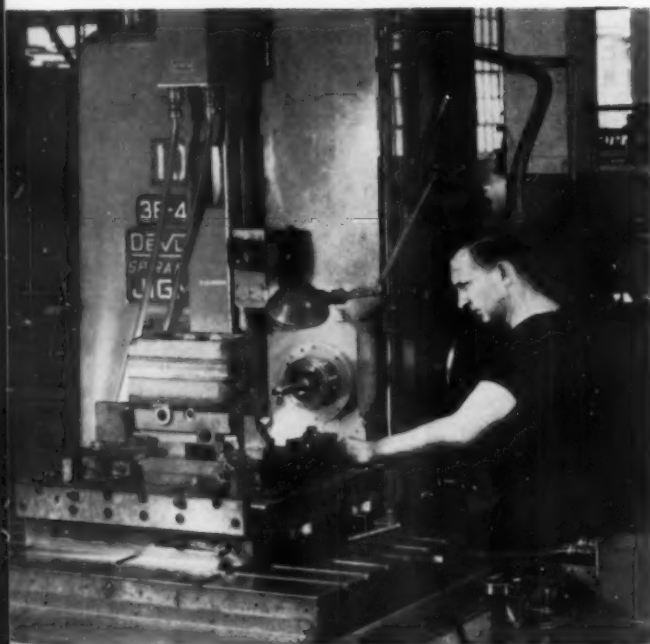


Fig. 1. DeVlieg precision boring and milling machine equipped with two pilot Probomats—one for horizontal control of table position, one for vertical control of spindle position. This machine is in production at Warner & Swasey's Cleveland plant.

All of these advantages can be obtained by methods other than numerical control. Selection of any one method is a matter of economics. The advantages listed should be individually analyzed before the decision is made.

Faster machining has not been listed as one of the advantages of numerical control for, with few exceptions, numerical control does not result in greater machining speed. Increased accuracy is not stressed, since accuracy depends, basically, on the accuracy of the machine tool itself.

It is doubtful whether numerical control will ever invade the field of mass production. When the same part is made day after day and month after month, it is possible to design a special machine or tool up an existing machine to produce the part faster than is possible with numerical control and usually at less original equipment cost.

Drilling the bolt holes in an automotive cylinder head is a good example. It is much more economical to drill all the holes simultaneously with a multiple drill head than it is to drill them in succession with a numerically controlled single-spindle machine.

Point-to-Point Controls: There are two basic types of numerical control: point-to-point positioning control and path control. Point-to-point con-

trols are relatively simple and are applicable to a wide variety of machine tools—boring mills, jig borers, drill presses, punch presses and the like, *Figs. 1 and 2*. These controls cost much less than path controls and can be added to existing machines. A package consisting of the necessary tables, servos and control elements can be added to drill presses or jig borers with no alteration.

Point-to-point positioning can also be applied to such machine tools as lathes and milling machines, where the stop and start positions of the tool are controlled by a tape and the operation of the tool between these two points is controlled by some other method. An added advantage of point-to-point positioning is that preparation of the control tape is simple: complex and expensive tape preparation equipment is not required.

Although point-to-point positioning systems have a broader range of application than path control systems, little data have been accumulated on the subject of costs and savings. This, perhaps, is understandable. Path control is more exotic, it solves problems that are extremely difficult to solve in any other way and it has the backing of the armed forces, with all the publicity they are able to give it. From the standpoint of interest, drilling a number of holes in a plate at a certain distance apart cannot compete with the machining of a complex workpiece such as an airplane spar. Nevertheless, the majority of applications of numerical control during the next five years will be of the point-to-point positioning type.

Despite the lack of cost data, most companies will find that it is comparatively easy to decide whether or not they can afford point-to-point numerical control. Warner & Swasey, for example, has found that it can afford numerical control, by adapting it to two different types of boring machines.

Also at the Warner & Swasey Co., the purchase of a numerically controlled boring mill has been thoroughly studied. This machine is somewhat more productive than the present conventional machines but, on the basis of labor savings, would require a 16-year period to pay for itself. However, savings in jigs and fixtures would amount to about two-thirds of the cost of the machine, plus savings in storage costs. With these savings, the net cost of the machine is brought down to where the machine will pay for itself in a reasonable amount of time. For this reason alone, it will be extremely difficult five years from now to sell a drill press, jig borer or boring mill without numerical control.

Path Control: It will be much more difficult for companies to justify numerical path control, unless they are making airplanes, missiles and the like. Path control so far has been largely limited to the machining of complex shapes. In this field,

where production quantities are usually small, it stands alone, but it is costly and complex.

Some of the savings achieved with numerical path control are astounding. For machining a set of four lower wing skins, three feet wide by eight feet long, Boeing Airplane Co. realized savings of nearly \$25,000. These parts were originally machined on a \$400,000 spar mill. The tooling cost was \$36,400 and the machining cost was \$8640. On a numerically controlled skin mill, which cost \$800,000, the tooling cost, including data processing, was \$19,170 and the machining cost was \$1440. In addition, there was a savings of some 3000 hours.

At the Northrop Aircraft, percentage savings have been equally impressive. In one instance, it was necessary to machine a $\frac{3}{8}$ -inch spiral groove, consisting of 22 semicircles connected by straight lines, in a 36 x 72-inch Meehanite casting. Tooling cost for the conventional method was \$696 and machining cost was \$160. Total cost was \$856. On a numerically controlled machine, the tooling cost, which consisted of data processing, was \$119 and the machining cost was \$196, a total of \$315. Setup time for the conventional method cost \$40; setup time for the numerically controlled operation included making a test run on a plywood workpiece at a cost of \$90. Deducting these costs, there is not too much difference in machining costs for the two methods, but the tooling cost for the conventional method is nearly six times that for tape control.

Time savings through numerical control were discussed by Lieutenant General C. S. Irvine, Deputy Chief of Staff, U. S. Air Force:

As to time savings, in certain tool fabrication jobs, work time has been reduced from 25 percent on simple work to as much as 90 percent on large complex die sets. And in the case of a structural test specimen, a

four-week lead time for the conventional method was reduced to four days. In another instance—a wing reinforcing doubler—the time of machining the first part was reduced from 25 hours to 66 minutes.

As an outgrowth of time reduction, machines which are numerically controlled can dramatically increase productivity. One machine, for instance, was able to turn out three parts during a normal eight-hour shift, whereas in a conventional operation its production rate was one per day.

Naturally, economy from the point of view of man-hour dollars results from such time reduction. One company, for example, was able to reduce the cost of making one die from over \$4000 to \$455. In another case, the tooling required for one forging on a trace type machine cost \$33,772. To obtain the same results, tooling for a numerically controlled setup cost \$7625.

Clearly, numerical control of machine tools has gained a substantial foothold in industry. Based on experience to date, there is no way for it to go but forward—and that at an accelerated pace. NCMT's are here, and they are here to stay. The economies stemming from them constitute a major breakthrough in manufacturing techniques. It is now up to industry, both large and small, to give vigorous impetus to the NC program. This is particularly applicable to modernization of methods by small business in order to prevent the small independent manufacturing concern from disappearing from the competitive scene.

This emphasizes the savings possibilities of numerical control where properly applied.

The following figures illustrate how difficult it is to make over-all statements about the advantages or disadvantages of numerical control. For a rear spar, 960 hours were required to produce 30 parts manually; 149 hours were required for production with tracer control; and 148 hours with numerical control. Setup time is included in all these totals. Thus numerical control had only a slight advantage over tracer control. On an engine mounting fitting, the comparative figures were 638 hours for manual operation; 491 hours for tracer-controlled operation; and 337 hours for numerically controlled operation. In this case, numerical control had a definite advantage. In a third case, 54 hours were required for manual production of a bearing plate; 64 hours for tracer-controlled production; and only 7.7 hours for numerically controlled production. From these figures, numerical control could not be justified for the rear spar, might or might not be justifiable for the mounting fitting, but would most certainly be justifiable for the bearing plate.

It is apparent that tremendous savings are possible with path control. However, it is equally apparent that each workpiece must be analyzed separately to determine if savings are possible.

Numerical control is not a panacea for all manufacturing problems. Like any other new development in machine tools, it has to stand on its own feet economically. In one short sentence: if it pays to use numerical control, use it; if it doesn't, don't.

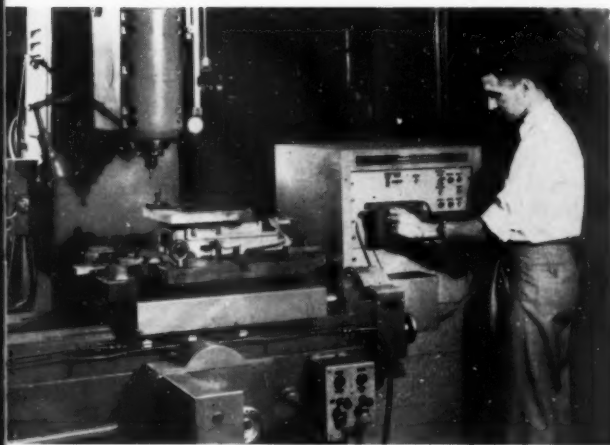
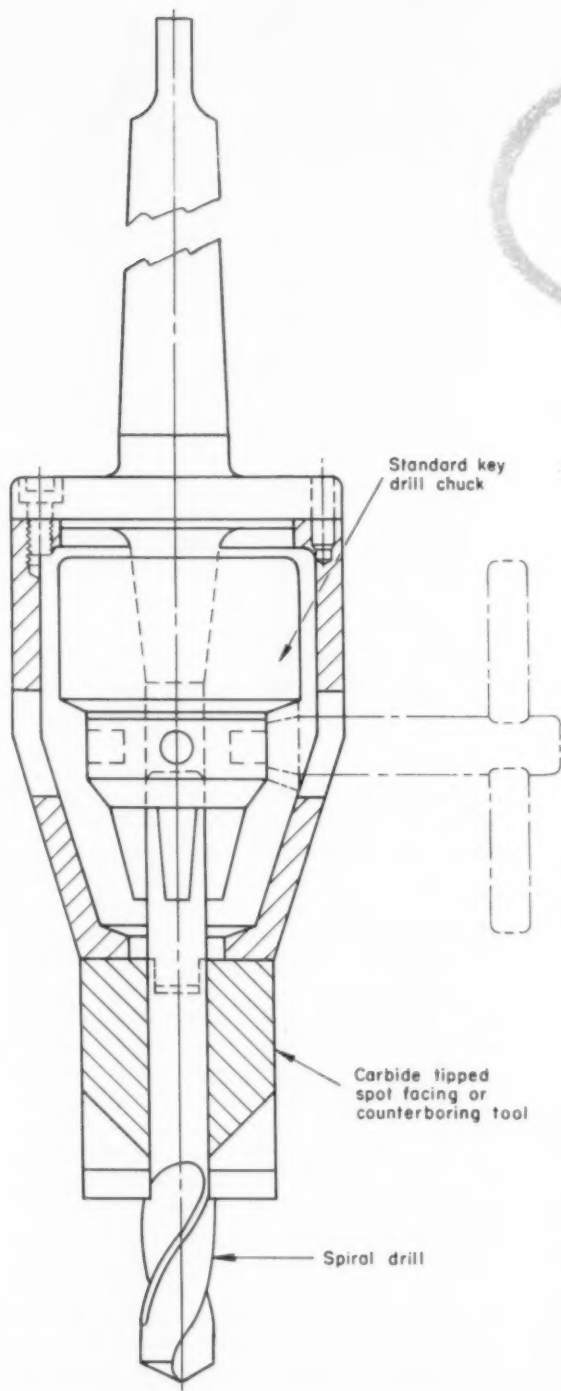


Fig. 2. Kearney & Trecker boring machine equipped with Tele-Probomat control—a simple numerical position control package that handles linear or rotary motions by tape control.

COMING!

Gadgets Contest begins October 1.
See list of cash prizes and other
details elsewhere in this issue.



Combination Drill and Facing Tool

Drills of high-speed steel and carbide-tipped facing tools can often be used at the same cutting speed. This principle is used for the combination tool illustrated which drills and spotfaces or counterbores in one operation. The chuck design can be made to accommodate a wide range of drill sizes and facing tools within the capacity of the drill chuck and Morse taper shank.

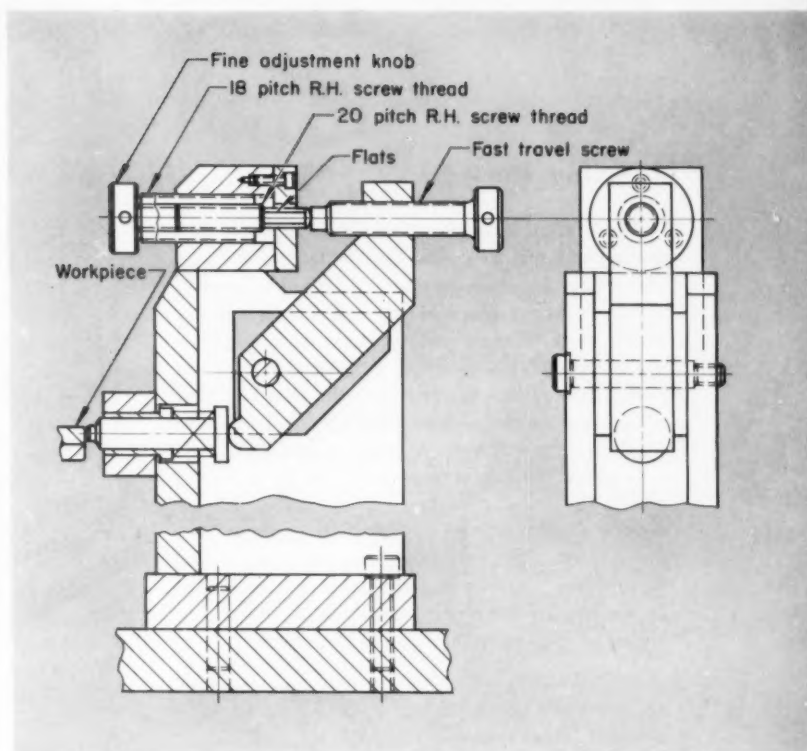
*William E. Sjöstedt
Member-at-Large
Södertälje, Sweden*

Locating Fixture

Heavy workpieces can be located and clamped within 0.0005 inch with the locating fixture shown. With the thread sizes indicated, one turn of the adjustment knob moves the inner screw 0.005 inch. Mechanical advantage of the clamp produces the desired movement of the workpiece.

Several locating units can be used for large parts. Finer or coarser adjustment can be obtained by changing the pitch of the screws and the length of the clamp lever arm.

*Donald H. Land
Louis Joliet Chapter*



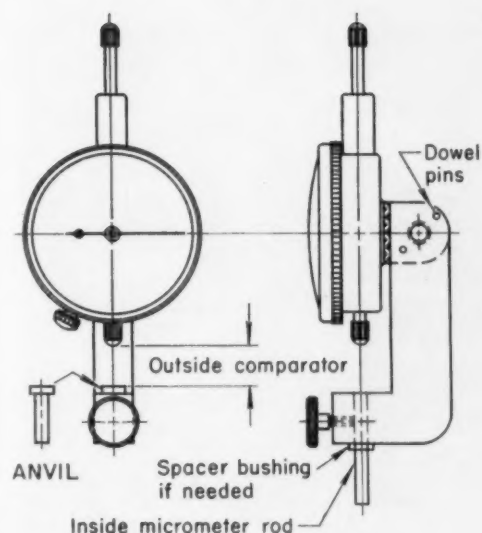
Inside Diameter Gage

When measuring inside diameters six inches and larger with a micrometer, results can vary as much as 0.005 inch depending on the skill of the operator. The inside measuring gage illustrated eliminates variables and gives accurate measurements.

The gage consists of a dial indicator mounted on a bracket with dowel pins and a cap screw. A micrometer rod, held in the bracket in line with the indicator stem by a thumbscrew, provides a means of adjusting the gage to a dimension close to that to be checked. The gage is set to the desired size with an outside micrometer.

The gage may also be used as an outside comparator for smaller dimensions by placing an anvil in the bracket hole for the rod on the same side as the indicator.

*Gus Johansson
Philadelphia Chapter*

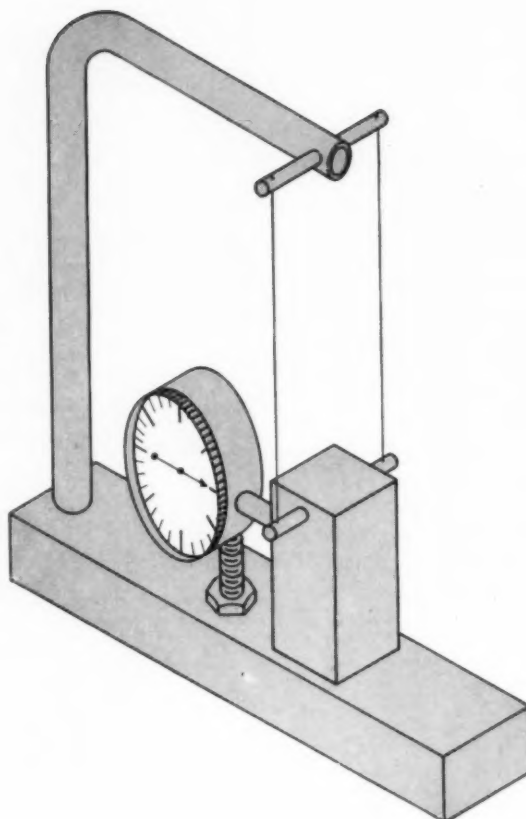


Leveling Device

The leveling device illustrated is useful when high accuracy is required. The bottom face of the base plate of the leveler is ground and lapped to produce a flat surface. A sensitive dial indicator is mounted on the block. A long bent rod is placed in a hole on the block and secured with a setscrew. A weight with a ground face is hung from the bent bar. The weight is supported by two wires arranged as shown to prevent the weight from swinging laterally.

In use, a reading is taken and then the leveler is turned 180 deg and another reading taken. The indicator should be tapped lightly to prevent frictional errors. The indicator should be sensitive and as free from friction as possible. Accuracy of the device can be improved by making the bent arm higher or increasing the size of the weight.

*Clint McLaughlin
Rockaway, N. Y.*



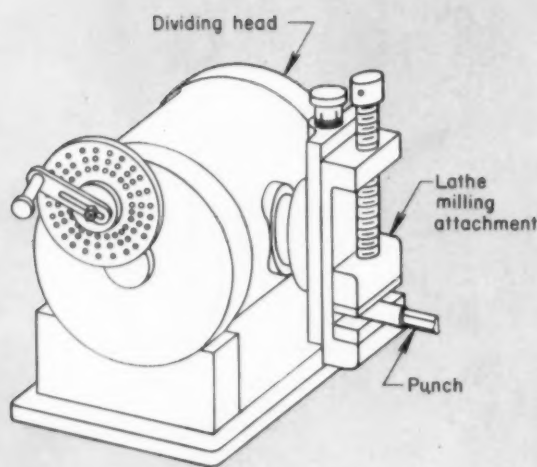
Punch Maker

Often a large toolroom is called upon to make a variety of odd-shaped punches. The contours required may call for a number of setups.

The device illustrated enables many different shapes to be machined with minimum setup time. A dividing head is combined with a milling attachment of the type designed for mounting on a lathe toolpost for light milling. The milling attachment is essentially a small vise on a slide base. A vise jaw with a deep V-notch is used in the vise. The notch must be on the center line of the dividing head spindle.

For angular shapes, the punch is positioned so that the spindle can be rotated as required to produce the proper angle between the faces. A radius can be ground on a punch by offsetting the milling fixture an amount equal to the radius to be ground on the punch. The radius is then ground by rotating the punch back and forth as the wheel is fed.

*William Martin
Brooklyn, N. Y.*



PIERCING WITH NUTS

cuts fastening costs

Economical fastening methods are a goal of tool engineers when planning either high or low-volume production jobs. The author describes how fasteners can be applied with minimum operations by using the nut as an expendable punch.

BASIC COSTS of processed parts usually constitute only 40 percent of production expenses as contrasted with 60 percent for the assembly of those parts. Fastening, being a major factor in assembly operations, is a fertile field for the reduction of costs. Many specially designed fasteners have proved the cost-saving potential in this area of manufacture. One method of applying fasteners to sheet metal assemblies which has resulted in reduced costs involves the use of pierce nuts.

These nuts act as punches to make their own mounting hole. Generally they can be applied wherever a hole can be pierced. Attachment of a nut is usually accomplished with a punch press either in a single operation or in progressive dies. *Fig. 1.* The nut is secured by coining the panel metal into an undercut in the nut, *Fig. 2.* At the same time that the nut is inserted, the panel metal may be embossed around the nut when extra strength or a flush mounting is desired. The piercing and coining is done in one operation, reducing piece-part handling and eliminating tool and tool maintenance costs of additional operations.

High-Production Application

Pierce nuts provide the fastening points for many automotive body assemblies. In the Chrysler radiator yoke, *Fig. 3,* 24 nuts are set in a battery of two manually loaded in-line presses.

All piercing stations can be mounted in one die

By John H. Steward

**President
Fabristeel Products, Inc.
Detroit, Mich.**

except that nuts are mounted on opposite panel sides and use of a double action press was not financially practical. Nuts are attached to the yoke on vertical inside sections, *Fig. 4,* at right angles to the die set by means of horizontal acting heads actuated by cams, *Fig. 5.* The punch press setup designed by Multifastener Corp. replaces the piercing dies required for the previous method. Eliminated in the new setup is a complete department composed of 27 semiautomatic attaching machines. Savings are approximately \$476 per day over previous methods.

Tooling

The tooling head actually performs several functions. It positions the nut, drives it through the panel and controls the area of the panel adjacent

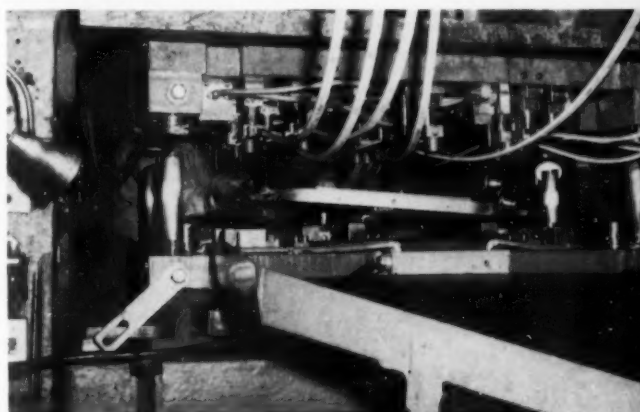


Fig. 1. Press operation for attaching pierce nuts. Plastic chutes convey nuts to die heads from overhead hopper feeders.

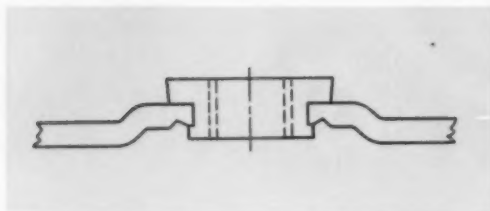


Fig. 2. Pierce nut affixed in metal. Panel swaged into undercut holds nut securely. Embossment may be added as shown to provide a flush surface.

to the nut, allowing for combination of metal forming and piercing operations. The head indicates whether the nut is properly positioned, corrects for over and under feeding and can be made to transmit a signal to control the press line. After the position of the nuts has been indicated, it is conducted through a sizing chamber to reduce the commercial nut to tool tolerances.

Reduction of commercial nut tolerances to tool tolerances is accomplished by setting the broached hole and the sizing chamber to the high limit of the desirable piercing tool tolerance for nut and metal specified. Nuts are fed from overhead hoppers through plastic chuting into the nut chamber to the head. Clearance of 1/32 inch is allowed over all high limits of the nut to insure an uninterrupted flow to this point. Then allowance is made for commercial nut tolerances and allowable percentage of deviation by gradual reduction of over-all di-

mensions as the nut is forced through the sizing chamber.

There are no loose shavings or chips resulting. The lead from the nut chamber at the point of entry into the sizing area is gradual. The only action is a small flow or upward wipe at the extreme edge of the nut never to an objectionable degree as the hopper selecting mechanism will not deliver nuts beyond condition of self-repair.

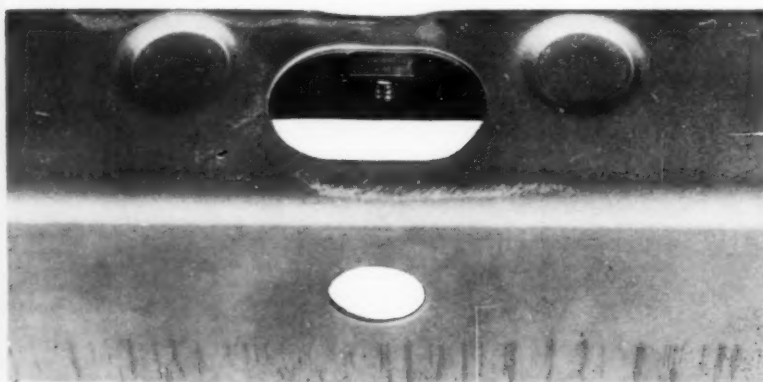
The nut has a workhardened steel body with all piercing surfaces having a hardness of over 100 R_B Rockwell. Consequently, the nut has adequate hardness to serve as a punch in piercing sheet metal ranging in thickness from 0.025 to 0.125 inch. With attention to the relation between metal thickness and nut wall thickness nuts can be punched into metal of 0.125 to 0.250 inch. Since the nut becomes part of the tool, it can be located precisely, thus allowing for close limits of fastener location. The nut is positioned until the exact moment of release by two fingers which form a retaining nest within the nut chamber. The fingers are timed and activated by the camming surface of the driving punch itself. The fingers and cam action cannot be activated until near the bottom of the stroke when the lower surface of the head sizing chamber has contacted the panel metal and is in proper relationship with the nut release. Protection against misfeeding of nuts is accomplished by an offset in the line of nut travel (an optional technique) and by the use of a simple cam arrangement to assure that the nut will be delivered correctly into the chamber.

Interruption of nut flow or partial entry of a nut into the chamber is prevented electrically. By inducing a direct current into the feeding line of nuts and using an insulated stop pin, the nuts themselves become a switch or contact. If the switch fails (when the nut is out of position) the circuit is incomplete. When misfeeding of the nut occurs and the circuit is not completed, the safety disconnect stops the press. The switching can be tied into the press controls in any manner desired.



Fig. 3. Pierce nuts are used on Chrysler radiator yoke for attaching front sheet metal, horn, headlights and radiator.

Fig. 4. Part of radiator yoke showing nut applied to inside of flange.



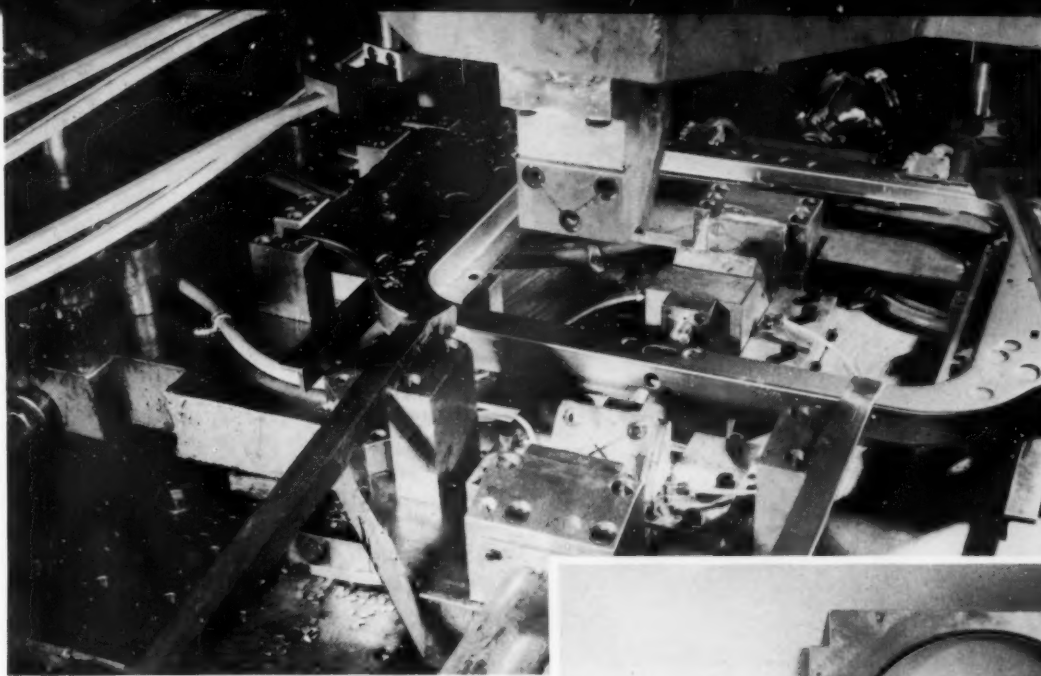


Fig. 5. Yoke in position with press open. Horizontally placed die head in foreground attaches nut to flange shown in Fig. 4.

In the case of the Chrysler yoke, a control panel is provided with lights indicating each nut station with fastening requirements of each part locked into the nonrepeat press control. Each fastening pattern and no other must be properly positioned in the nut chamber before the press will cycle. Solenoids insure proper position of the panel within the die as well. Feedback signal is used as the circuit signal since the flow of current is fully grounded and leakage is actually utilized.

Experience has shown that installation stop blocks within a die by no means insure that they will be used properly. When the die fails to bottom properly, the nut may be pierced through the panel without the metal being secured to the nut. Also, should a die travel past correct position of bottoming it is possible to drive the nut partially through the metal and weaken the effect of assembly strength.

Registry of each assembly of nut and panel is provided for the purpose of protecting against improper setting of the die. This registry is effected by the use of the letters "N" and "G" contained within a circle on the die. These letters will not imprint unless the ram is brought down to the point of the properly installed nut. At that point the "N" is ground back 0.0035 inch. When the "N" fails to imprint, the "G" indicates good. Whenever the top die shoe overtravels for any reason, the "N" appears. A casual glance reveals an incorrect die setting.

A basic consideration must be met to insure uninterrupted material flow. The hoppers must contain a sufficient supply of nuts to guard against

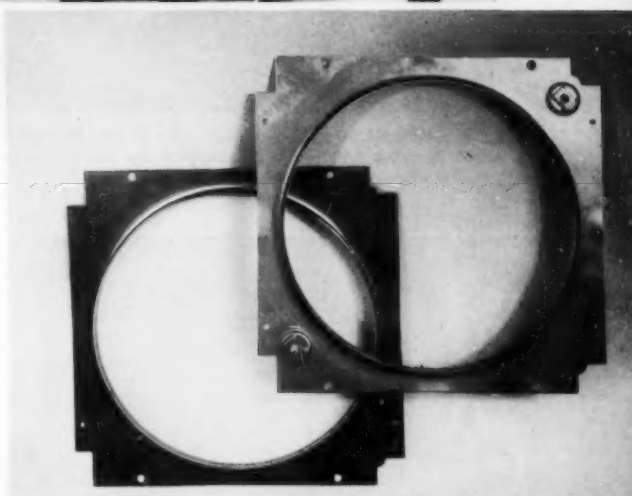


Fig. 6. Shroud plate housing is tooled for low-volume production. Embossing is accomplished with same press stroke as piercing.

frequent depletion and must operate in a self-clearing fashion. Chips, misshapen nuts and foreign material must not be allowed to jam or impair the feeding mechanism.

Small-Lot Production

Off-the-shelf die sets make this method of fastening economical also for products made in short runs. The self-contained units retain the feature of sizing nuts, and incorporate simultaneous embossing, sealing or lock impression when required. A low-production job accomplished with this type of tooling involves the manufacture of bus and truck heater products at Evans Products Co. Standard units are used to attach two nuts with simultaneous embossing on a fan shroud plate, Fig. 6. Fifteen different types of heater fan shroud plates are made with the same setup, employing different fixtures or different locator positions for each part.



Fig. 7. Panel is placed manually in press. Die heads and locating fixtures are moved on the die set to accommodate different types of parts.



Fig. 8. Designed for low-production applications, die head is fed by hand-loaded magazine.

Heads may be moved quickly and easily to any position required. Instead of hopper and plastic chute feeding, stapler type magazines with spring-loaded feeding mechanisms are used. These magazines are hand-loaded, Fig. 8. Using the pierce nuts cuts unpainted panel costs approximately in half from former method of using weld nuts.

Advantages and Limitations

Pierced nuts offer production advantages such as reduced handling, adaptability to automation, economy of manpower, compactness of setups, and re-

duction in banks and storage. In piercing its own hole the nut not only eliminates cost of punches and maintenance but offers maximum resistance to vibration, tension and shear effects.

Recent attempts to provide standard low-cost, self-contained piercing units point up the difficulty of amortizing special tooling costs over low-production runs. With low production it is advisable to use only standard piercing units which have universal application. Nuts to be installed in deep draws or multiple planed surfaces generate tooling costs difficult to successfully amortize unless production is relatively high.

Special attention must be given to correct ram setting to insure that the metal is coined firmly into the undercut area of the nut. If the ram is not driving the nut home, a high percentage of the retention is lost. Self-piercing attachment is only as strong as the metal around the nut. In critical applications where unusually high torque is required in light gages, pierce nuts are not recommended.

The metal secured in the undercut is for installation retention only. After assembly the load must pull against the shoulders as shown in Fig. 2. Installation retention varies from 400 lb with 1/4-20 thread size in 0.035-inch sheet metal to 1850 lb with 3/8-24 thread size in 0.125-inch sheet metal.

Other Operations

Since the driving punch is mounted rigidly to the top die shoe and the limits of its travel can be accurately controlled at the bottom of a stroke, projections can be made in the punch to throw the last two threads out of phase to maintain a closely controlled distortion. This produces a locknut customized to entry or backoff torque requirements wherever specified.

In controlling the metal adjacent to the fastener, in effect the nut is fed through a conventional embossing or restrike die section. Most frequently this feature is used for a panel strengthening depression or embossing around the nut to allow for flush mounted assembly. It is also common to rib, restrike, form and lance. A recent development has been that in coining of the metal to the nut by using a radius on the corners of the die button, an effective seal can be made. This provides a fastening which restricts leakage of dirt, moisture and vapor pressures. Formerly, this was accomplished by using highly specialized fasteners or mastic sealing.

Another operation under development is subassembly of two panels with pierce nuts. In this application two sheets of metal are pierced at the same time. The nut travels through both sheets and fastens them together, providing a fastening operation in addition to a fastener attachment operation. Only metal from bottom panel is coined.

High Temperature Brazing Filler Metals

... properties and uses

By D. C. Herrschaft

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Demands of rocket and missile designers for high-temperature performance have resulted in the development of new brazing materials and new brazing techniques. These are described by a noted application engineer.

DEMANDS OF THE SPACE AGE have created a need for high temperature brazing filler metals. The region just below 1000 F represents the threshold of high temperature service. Below this dividing line lies an intermediate range where the silver-base alloys, which have been widely used for room

and moderately elevated temperatures, can provide useful service. These alloys, which flow in the range 1200 to 1750 F, retain about half their room-temperature strength at 500 to 800 F. They can sometimes withstand temperatures up to 1000 F for brief periods under nonoxidizing conditions. Within this group, silver manganese and sterling silver have the best temperature characteristics, but their oxidation resistance and strength are generally considered poor for continuous service above 900 F.

For service above 1000 F, nearly a dozen alloys are known or have been proposed. Four types that melt at 1750 F and above have reached commercial development. In descending order of high-temperature utility these are nickel-base, palladium-base, gold-base and manganese-nickel alloys. As might be expected from the widely different compositions, these alloys are different in brazing characteristics and service properties. This fact, plus considerations specific to the nature of the brazing cycle and the base metal to be brazed, make it almost impossible to single out the best brazing alloy for high

temperature service. Selection of a brazing alloy must be approached from the standpoint of the best combination of alloy and base metal for the assembly, when brazed in production.

Nickel-base Filler Metals

These alloys contain from 73 to 93 percent nickel in combination with one or more of the following elements: chromium, to increase corrosion resistance; and boron or silicon, to improve wetting and reduce melting temperature. The more familiar filler metals in this group are listed in TABLE 2. Brazing temperatures range from 1900 to 2200 F. These materials are available in powder form, or as simulated wire or sheet made from the powder, using an acrylic binder that volatilizes completely during the brazing cycle.

As a group, the alloys have excellent oxidation and corrosion resistance. Being quite hard, they produce high-strength joints under proper brazing conditions. They can be used continuously at temperatures up to at least 1500 F and intermittently up to 2000 F. Depending on the base metal in-

volved, joints have ultimate tensile strengths of nearly 100,000 psi at room temperature and 30,000 psi at 1500 F as shown in Fig. 1.

Part of the high-temperature strength of these materials can be attributed to the formation of new alloys which remelt at temperatures higher than the original filler metal. However, they have some serious limitations that must be considered.

Penetration of Stainless Steels: The nickel-base fillers containing boron or silicon tend to dissolve stainless steel at a rate 4 to 5 times greater than copper or manganese-nickel. In addition, the boron-containing materials also cause intergranular penetration. The degree of penetration appears related to the complexity of the base metal, being most severe on stainless steel and the superalloys. Because of their tendency to attack stainless steel, boron-containing materials should be used only on sections thick enough to be relatively unaffected by the amount of attack and with adequate precautions to minimize the amount of penetration. The boron-free Ni-Cr-Si filler metals do not penetrate stainless steel to such a great extent, but require a higher

Table 1—Properties of Four High-Temperature Brazing Filler Metals

Alloy Type	Advantages	Limitations
Ni-Si-B	<ol style="list-style-type: none"> 1. Acceptable brazing temperature (1950-2150 F) 2. Highest strength at high temperature 3. High oxidation and corrosion resistance 	<ol style="list-style-type: none"> 1. Low ductility 2. Strong tendency to dissolve base metals 3. Causes intergranular penetration 4. May form brittle intermetallic compounds 5. Joint gap affects strength and reduces ductility 6. Tendency to liquitate due to wide melting range 7. Not available in wrought forms
Au-Ni and Au-Ni-Cr	<ol style="list-style-type: none"> 1. Acceptable brazing temperature (1800-1950 F) 2. Maintains high strength to 1400-1500 (F) 3. Excellent oxidation and corrosion resistance 4. Good joint ductility 5. No intergranular penetration 6. Available in wrought forms 7. Au-Ni flows at its melting temperature 	<ol style="list-style-type: none"> 1. High cost 2. Melting temp may be too low for service
Pd-Ni-Cr	<ol style="list-style-type: none"> 1. Strength, oxidation and corrosion resistance comparable to gold-base alloys 2. About 1/4 to 1/5 cost of gold-base alloys for a given joint volume 3. Working temperatures can be reduced by adding gold to the composition 	<ol style="list-style-type: none"> 1. Brazing temperature about 2300 F 2. More costly than Ni-Si-B
Mn-Ni	<ol style="list-style-type: none"> 1. Acceptable brazing temperature (1900 F) 2. Good strength at high temperature 3. No intergranular penetration 4. Metal dissolving tendency moderate 5. Compatible with most structural metals 6. Brazed assemblies can be welded 7. Narrow melting temperature range 8. Available in wrought sheet form 	<ol style="list-style-type: none"> 1. Poor oxidation resistance above 1000F 2. Limited corrosion resistance with stainless Steel

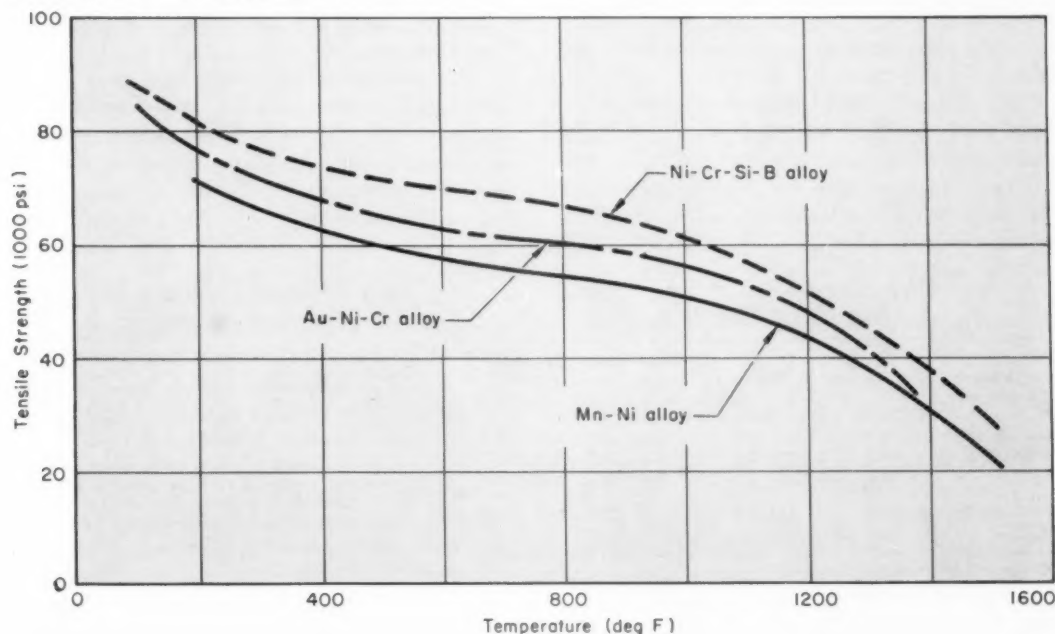
brazing temperature, about 2200 F. In addition, the silicon forms brittle intermetallic compounds with the base metals which reduce joint ductility.

Sensitivity to Joint Clearance: Although the amount of clearance affects the strength of any brazed joint, joints made with the high-nickel fillers are exceptionally sensitive. Joint strength is maximum with a nominal zero clearance, and decreases by 30 to 70 per cent as the clearances increase to only 0.004 inch. Chang^{1&2*} showed that butt joints in AISI 347 stainless steel, tensile tested at room temperature, failed at 86,000 psi with zero clearance; at 33,000 psi with 0.004 inch clearance.

Joint ductility is affected more severely and is lost almost completely when the clearance is increased from zero to 0.004 inch. The sharp drop in joint strength and ductility is largely attributable to the tendency of boron, silicon, and carbon in the filler metals to form hard intermetallic compounds. At zero clearance, the relatively small amounts of these elements present in the joint enables them to diffuse largely into the base metal, leaving the joint much lower in boron or silicon compounds. As the joint clearance increases, the larger quantities of alloying elements present cannot diffuse completely into the base metal and some portion remains in the joint to form the brittle

* References are listed at the end of the article.

Fig. 1. Typical brazed joints showing tensile strength values for Ni-Cr-Si-B alloy joints when used with AISI 347 steel, in test samples of AISI 347 steel with Au-Ni-Cr alloy brazed joints and Mn-Ni alloy brazed joints used with AISI 304 steel workpieces.



phases. It is obvious that good joint strength and ductility can be retained by holding joint clearance and the amount of filler metal to a minimum.

Tendency to Liquation: Complex composition of these filler metals causes the various portions of the material to become fluid at different temperatures. Liquid portions flow into the joint leaving behind a semisolid skull of the remaining constituents which have melting points at or above the top temperature of the brazing cycle. As a result, there may be insufficient alloy to fill the joint, and the residual skulls cause poor appearance and irregular joint strength. To avoid this, the filler metal must be brought up through the melting range as quickly as possible to reduce the extent of liquation. This can be done either by operating the furnace well above the flow point of the highest constituents, about 2200 F, or by stabilizing the assembly at about 1750 F. Then the temperature is rapidly increased at a rate of 50 deg F per minute to attain the required brazing temperature.

Additional Brazing Considerations: Brazing with high-nickel fillers requires close control. Filler metal should not be preplaced in the joint. It is placed adjacent to the joint where the molten alloy can fill the gap by capillary action. This helps minimize joint clearance and decreases the degree of solution and penetration due to the reduced amount of filler metal in the joint. In every case, the amount of filler metal used should be carefully controlled to avoid an excess at the point of preplacement. Also, it should be preplaced at the

thickest available section of base metal.

The time-temperature cycle also directly affects the degree of solution and penetration. Time at brazing heat should be as short as possible, depending on the ability of the alloys to fill the joint. Ten to 20 minutes at temperature is optimum.

Gold-Base Filler Metals

These alloys offer almost all the advantages of the Ni-base fillers with none of their limitations. Two of the most commonly used compositions are listed in TABLE 3. Brazing temperature is about 1850 F for the gold-nickel binary, and about 2000 F for gold-nickel chromium. The alloys are quite ductile and are available as wire, strip and sheet. Due to its chromium content, the gold-nickel-chromium material surpasses the high oxidation and corrosion resistance of straight gold-nickel alloys. Its chief advantage, however, is lower cost due to 12 percent lower gold content. Joint strength with the gold-base alloys is about equal to that obtainable with the nickel-base alloys at all temperatures up to 800 F and is about 10 percent lower at 1200 F, as shown in Fig. 1. In type 347 stainless steel, joint failure occurs in the base metal up to 800 F and in the joint at higher temperatures, though tensile strength remains high, about 45,000 psi at 1200 F. In addition to high strength, joints have excellent ductility since the alloys have little tendency to form brittle intermetallic compounds with base metals. As a result, larger joint clearances do not produce brittleness and reduced strength as is frequently the case with the nickel alloys. In fact, the strength of gold-nickel joints in type 347 steel at elevated temperature has been found to improve when clearance is increased to 0.004 inch, due to the greater amount of alloying with the base metal. The gold-nickel binary alloy has the further advantage of a short melting range. Since it does

not liquefy, it can be brazed without special attention to heating rate through the melting range.

The oxidation resistance of the gold alloys is excellent and equal to that of the Ni-Cr-B-Si alloys. Both types show little reduction in tensile strength when joints in type 347 stainless steel are exposed to oxidizing conditions at 1500 F for eight weeks.

The gold-nickel alloys dissolve and penetrate stainless steel to a moderate degree, but far less than the high nickel materials. They may be safely used on thin sections provided the amount used is not excessive and the brazing cycle not too long.

Besides fairly high cost, perhaps the most serious limitations for the gold-nickel and Au-Ni-Cr alloys are their relatively low solidus points—1740 and 1785 F—which limit maximum service temperature to about 1600 F, several hundred degrees lower than the nickel-base group. The alloys do not readily attain the higher remelt temperatures characteristic of the nickel-base fillers.

Palladium-Base Filler Metals

Alloys of this type are the most recent addition to the group of high-temperature brazing materials. Many different compositions have been made experimentally, but the most satisfactory composition to date is 54 percent palladium-36 percent nickel-10 percent chromium. This alloy flows at 2300 F.

Because palladium-nickel is still relatively new in application, little specific data is available about its properties. However, it is generally comparable in strength, oxidation resistance and corrosion resistance to the gold nickel alloys. Its primary advantage over the gold alloys is lower cost—about 1/4 or 1/5 that of the gold alloys for a joint of the same volume.

For elevated service temperature requirements, the high flow point, 2300 F, of palladium nickel can be a decided advantage. Where it is necessary to

Table 2—Compositions of Some Typical High-Nickel Filler Metals

Alloy Classification	Composition (%)					Temperature (deg F)		Specification Number
	Ni	Cr	Si	B	Fe & C	Melt	Flow	
Ni-Si-B	91.3	---	4.5	2.9	1.3	1800	1825	AMS*4778
Ni-7Cr-Si-B	82.0	7.0	4.5	2.9	3.6	1800	1825	AMS 4777
Ni-15Cr-Si-B	72.5	16.0	5.0	3.5	3.0	1825	1840	AMS 4775
Ni-Si-low B	93.3	---	3.5	1.9	1.3	1900	1930	AMS 4778
Ni-Cr-Si	70.3	19.0	10.0	---	0.7	2100	2150	

*Aircraft material specification.

Table 3—Typical Gold-Base Filler Metals

Alloy Classification	Composition (%)			Temperature (deg F)	
	Au	Ni	Cr	Melt	Flow
Au-Ni	82	18	---	1740	1740
Au-Ni-Cr	72	22	6	1785	1900

For special conditions, alloys can be formulated to fit the material and temperature limitations of the application. Substituting palladium for part of the gold content increases the melting temperature of the alloy.

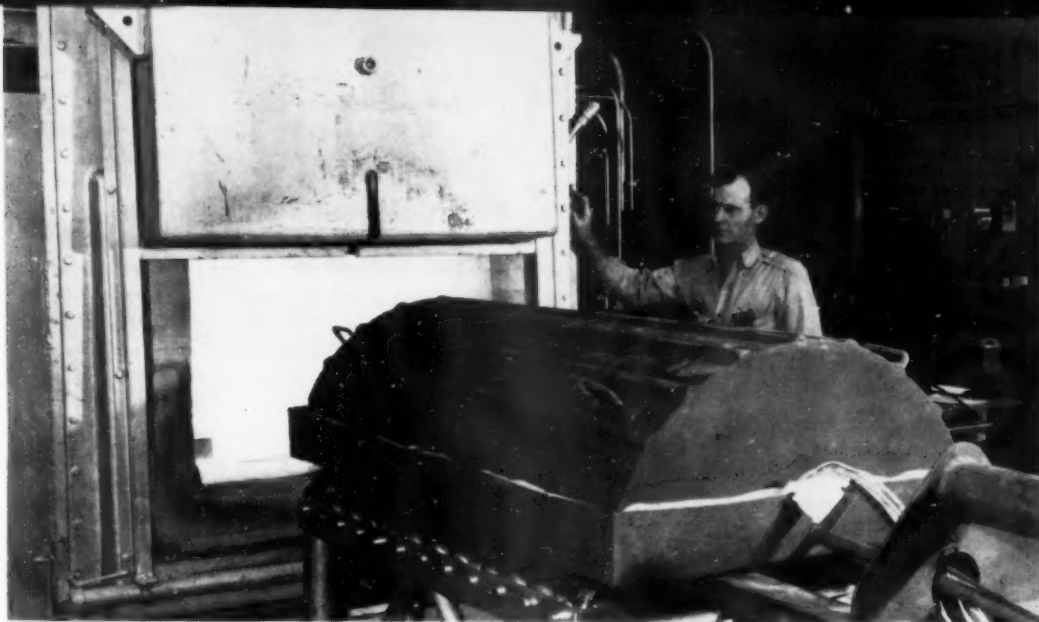


Fig. 2. Sand-sealed retort entering a high-temperature brazing furnace. Argon and vacuum lines as well as

thermocouple leads pass into the retort through the sand at the end of the container.

reduce the working temperature, the composition can be modified by adding gold to make quaternary alloys having melting points between those of 54 percent Pd-36 percent Ni-10 percent Cr as the upper extreme and 72 percent Au-22 percent Ni-6 percent Cr as the lower extreme. It is necessary, however, to add 50 percent or more of gold to reduce the flow temperature about 150 F.

Manganese-Nickel Filler Metal

This alloy might be considered as an alternative to the gold and palladium base alloys where cost is a paramount consideration. The most widely used composition is 70 percent Mn, 30 percent Ni a composition which melts at 1885 F and flows at 1920 F. It offers reasonably good short-time tensile strength at temperatures up to 1500 F, *Fig. 1*, about 25 percent under the strengths obtainable with gold-base alloys. Solution and penetration characteristics are about the same as for the gold-base materials, and its filleting properties are good. Its solution characteristics with stainless steel are moderate and uniform. The alloy is available in sheet form down to 0.002 inch thickness. It is compatible with most base metals, and assemblies brazed with the alloy can be welded without difficulty.

The major limitation of manganese-nickel is susceptibility to oxidation. It should not be used in applications requiring good oxidation resistance above 1000-1100 F. Specimens of the alloy exposed to air at 1300 F for 65 hours were found to develop deep scaling. However, its oxidation resistance is 3 to 6 times better than that of silver-manganese or silver-copper as evaluated by relative depth of scaling after 1000 hours at 1000 F.

Base Metal Preparation

Some special precautions are necessary when brazing with certain high-temperature filler metals. Excess filler metal and prolonged heating should be avoided, to minimize the effects of solution and penetration. Size of joint gaps must be controlled to secure maximum strength and ductility. Special techniques are also needed because of wetting problems with certain kinds of heat-resistant base metals, regardless of the type of brazing alloy used. The difficult-to-wet base metals are generally those containing aluminum or titanium, which form oxides that are too stable to be reduced by any brazing atmosphere obtainable on a practical production basis. With the silver-base alloys, the problem of wetting aluminum and titanium-bearing base metals has been largely solved by adding about 0.2 percent lithium to the brazing alloy as an oxygen scavenger. However, with the high-temperature alloys there is no practical way of incorporating such a deoxidizing agent into the composition to solve the wetting problem. The problem must be handled either by special preparation of the base metal surface or by special brazing techniques.

For brazing purposes, the heat-resisting base metals can be divided into two groups—those whose oxides can be reduced during the brazing cycle, and those which require preliminary preparation. All base metals in the first group can be brazed in either an inert atmosphere, vacuum or dry hydrogen at a dew point of -60 F or better. This group contains all iron and nickel-base alloys containing chromium, but no titanium or aluminum.

The second group includes all highly-alloyed base metals, that is, the superalloys which are iron,

nickel and cobalt-base materials containing chromium, titanium and or aluminum. It also includes molybdenum alloyed with 1/2 percent titanium. Representative alloys in this group are: 17-7 PH steel, which contains 1.2 percent aluminum; A-286, which contains 2 percent titanium and 0.17 percent aluminum; and R-235, which contains 3 percent titanium and 1.5 percent aluminum.

Four different techniques have been suggested for brazing these alloys:

Electroplating: This technique involves electroplating the joint surfaces with a metal whose oxides are easily reducible by dry hydrogen. The plating metals used may be nickel, copper, silver or iron, whose oxides are easily reduced under high temperature brazing conditions.

Several limitations are reported for this procedure. At 1400 F, the strength of a nickel-surfaced joint brazed in a hydrogen atmosphere is about half that obtainable with vacuum brazing, and about three-quarters of that obtained in a flux joint brazed in the hydrogen atmosphere. Not all configurations can be plated conveniently, and the plating operation is expensive. Furthermore, it is sometimes difficult to obtain a plating thick enough to prevent the titanium and aluminum from diffusing through the plating surface during the brazing cycle and interfering with wetting. Work done on A-286 and R-235 shows that a nickel plating 1 to 2 mils thick is effective for producing joints with Ni-Cr-B alloys during 15-minute heating from room temperature to brazing temperature.

Controlled Oxidation and Leaching: The second procedure is forming the titanium and aluminum oxides on the joint surfaces by exposure to moist hydrogen, -40 F dew point. The oxides are then removed chemically by a nitric-hydrofluoric acid pickle, which leaves the surfaces oxide-free and brazable in dry hydrogen.

To be successful, the brazing cycle must be short to prevent the titanium and aluminum from diffusing out to the surface. The heat input required to bring the work up to brazing temperature is attainable only if the parts have low mass. With large parts, the rate of temperature rise cannot be rapid enough to avoid the diffusion problem.

Preplacing the Filler Metal: This procedure takes advantage of the fact that, even though a brazing filler metal will not flow on aluminum and titanium oxides, it will reduce these oxides if in direct contact with them. The filler metal is applied to the joint surface by flame spraying. The technique has produced excellent joints with Ni-Cr-Si and Ni-Si-B on Inconel 702 and A-286. It has two major limitations. Only certain configura-

tions can be spray-surfaced conveniently and the brazing filler metal will not flow into any part of the joint area where it was not preplaced.

High Vacuum Brazing: The fourth method, which appears to be the most versatile, is to grind the joint surfaces and braze in high vacuum, Fig. 2. This method has produced joints of excellent quality in base metals such as A-286, Inconel 702, R-235 and 17-7 PH. These could not be brazed even in hydrogen atmospheres. The work must be brazed at one micron pressure or less for best results. In some cases, this must be supplemented with titanium chips as a "getter."

Of the four types of brazing filler metals for service beyond 1000 F, the gold-base alloys have the best combination of properties. They possess high strength, excellent oxidation and corrosion resistance, and generally are convenient to handle and braze. Their major limitation is high cost. However, it appears that palladium-nickel-chromium alloys offer about the same properties as the gold-base materials, and at lower cost. The high melting point of the palladium alloys can be advantageous for high-temperature service, but where a lower melting temperature is desired for brazing purposes, it can be achieved by adding gold to the formulation. It is possible to tailor the melting point between the extremes of 1780 and 2300 F by increasing palladium and reducing gold content. The substitution of palladium for gold leads to progressive reduction in alloy cost. Further experience is needed to define the service properties of the palladium-base alloys more precisely.

References

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2. Chang, W. H., "Basic Characteristics of Some Heat-Resisting Filler Materials," *Ibid*, p. 431-443, Sept., 1956.



"I had in mind some simple little tool engineering job that would skyrocket me to the top—"

designed for

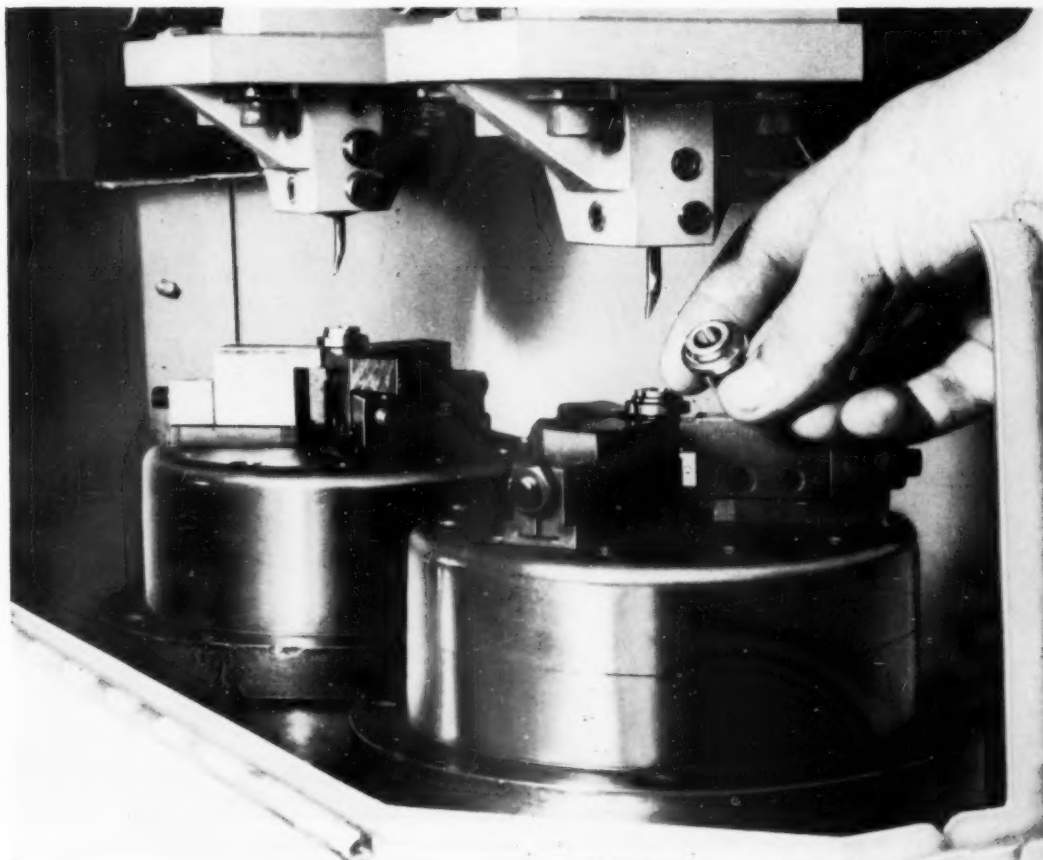
PRODUCTION

Contour Boring Precision Parts

Finish boring and contouring the inside diameters and contours of small jet engine fuel nozzles demands precision with an excellent finish. On a stainless steel part, such an operation is performed at the rate of 184 parts per hour on an ExCello cam-operated precision boring machine.

Clamped in three-jaw diaphragm chucks, two parts are machined simultaneously. After starting

the cycle, the cam follower engages the table cam and finish boring starts. At the end of the straight section of the bore, coordination of both table and cross slide cams causes the boring tools to follow their predetermined paths and precision generate the inside contour. Boring tools with 0.003 inch radii feed over into the 0.022 inch diameter end hole before the table rapidly traverses back.



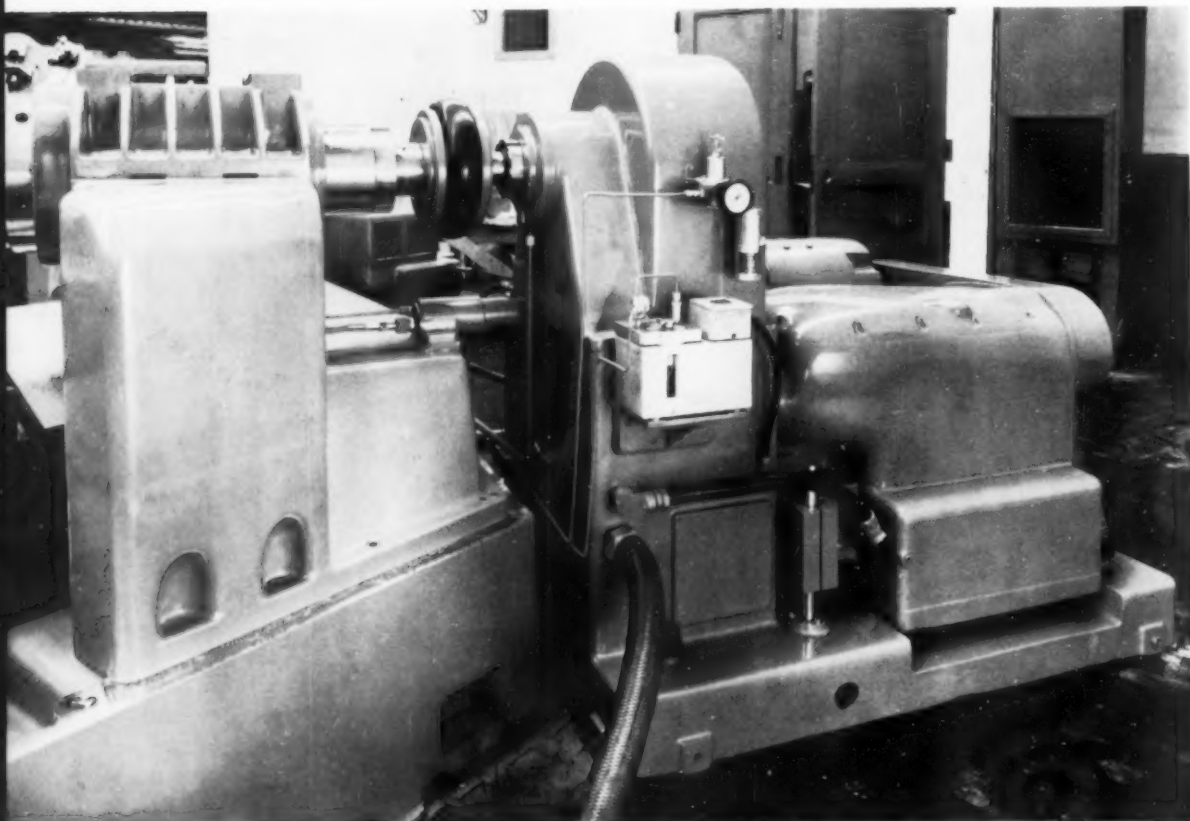
Contour Turning to Close Tolerances

Contour turning to ultra-precision tolerances requires a machine and control system that assures repeatability and accuracy as an integral part of the machine tool. To perform this type of operation on thin wall spherical and related shape workpieces, the Monarch Machine Tool Co. has developed a chucking type lathe with its spindle set at 30 deg to the bed axis. Run out at the nose is less than 25 millionths.

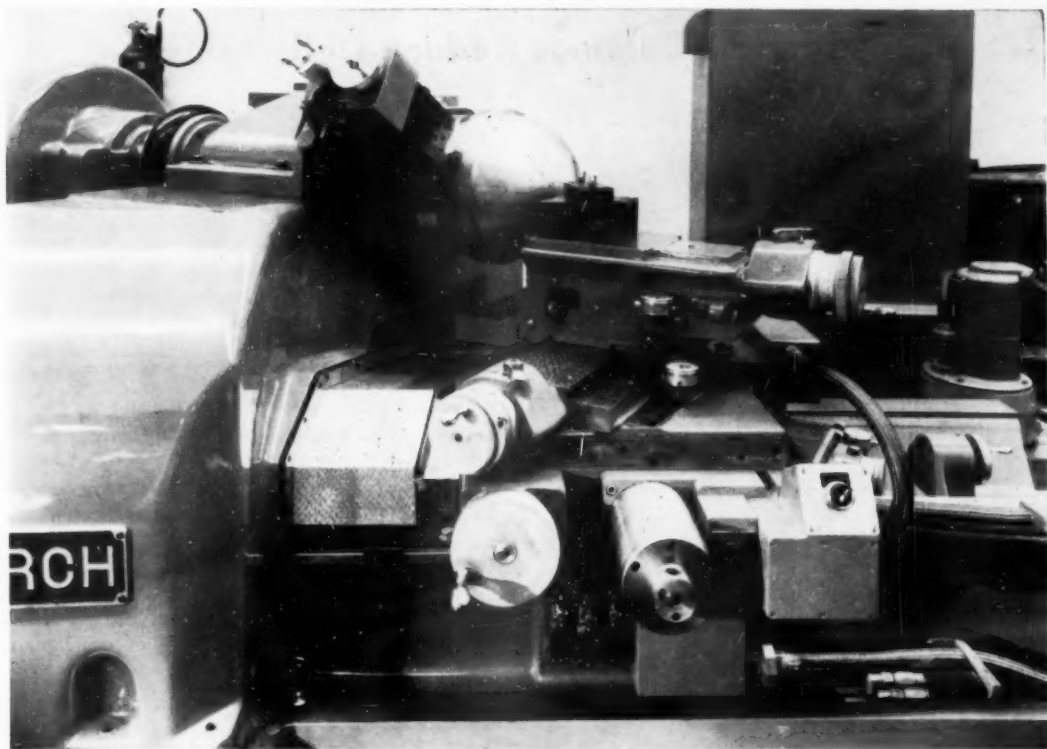
The infinitely variable d-c drive is connected to the spindle by a flexible coupling to prevent transmittal of vibration from the drive to the bed. A constant surface cutting speed over a 6 to 1 ratio is held with a speed range of $8\frac{1}{2}$ to 1000 rpm.

To prevent the spindle from affecting the desired tolerances, spindle bearing lubricant is refrigeration cooled to keep it at room temperature. In addition, the coolant is maintained at a constant temperature within plus or minus 5 F by water-cooling coils.

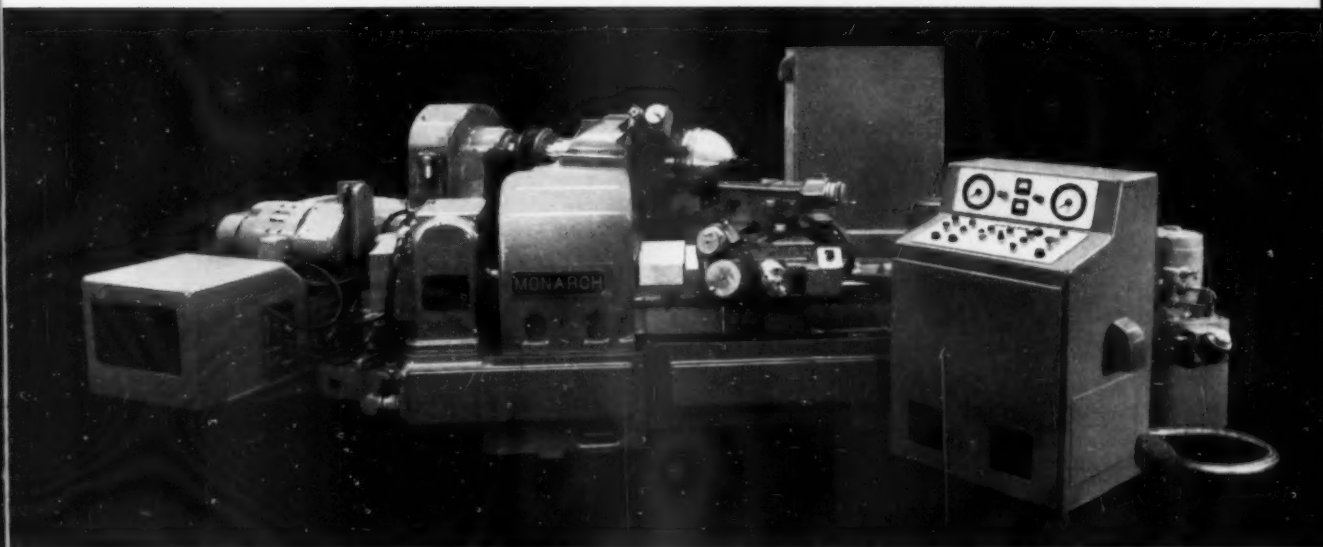
Slide positions are controlled by an electric-hydraulic tracing system within 20 millionths while tracing around a template. This is the total accumulated error from the tracer stylus to the tool point. To maintain accuracy, the unit is operated in a temperature controlled area and the hydraulic fluid in the tracer system is maintained at a constant temperature for proper operation.



DRIVE MECHANISM is mounted on a separate base and coupled to the spindle by a flexible coupling.

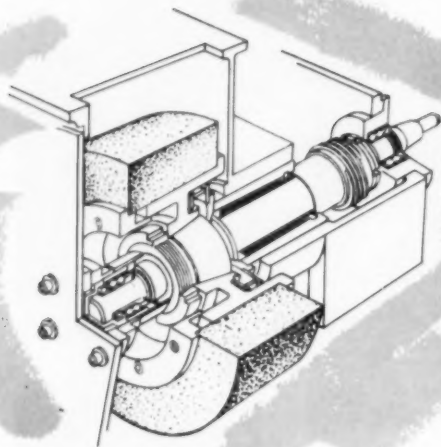


CROSS SLIDE moves on large preloaded steel balls to minimize friction. Two tool adjusting slides permit tool adjustment both parallel to and at right angles to the spindle axis. The tracer head is mounted directly on the tracer slide while the template is located below the carriage between the bed ways.



DURING OPERATION, the operator controls all motions of the lathe from the console located at the right.

Straddle Bearings Reduce Deflections



STRADDLE BEARING SPINDLE CONSTRUCTION with antifriction bearings on both ends of the spindle. Wheel changes are facilitated by swinging back the combination support bracket and wheel guard in the foreground.

Deflection of the spindle during grinding affects the precision of the workpiece. In a centerless grinder developed by the Norton Co. this condition has been minimized by a special straddle bearing design on both wheel spindles.

Both ends of the spindle shaft are supported on antifriction bearings to reduce the tendency of the spindle to flex from the weight of the wheel and from grinding pressure. Since the spindle does not deflect, more consistent sizing and better finish on through-feed operations with less truing is possible.

Another interesting design feature of this machine is the hydraulically powered truing unit. When a simple directional lever is pushed, the diamond moves to the rear. When pulled, the diamond traverses toward the operator. Truing speed is adjusted by controlling the rate of hydraulic oil exhaust. Truing slide horizontal motion is controlled by gibbed antifriction ways to give positive tracking for contours.



OPERATOR LOADING A WORKPIECE in the grinder. Truing devices for the grinding and regulating wheels are mounted on the upper portions of the machine guards.

putting

LEARNING CURVES

to work

By Lou Wertman*

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An understanding of learning curves makes it possible to accurately forecast the production time for assembly work and other operations where efficiency is dependent on operator skill. Thus future schedules can be determined on a realistic basis and piece costs can be estimated with greater accuracy.

LEARNING CURVES are based on a fact that is familiar to all tool engineers. As workers acquire skill on a particular operation, their productivity increases. This increase follows a definite pattern for all comparable jobs. For automatic operations, operator skill is, in effect, built into the machine and the learning curve can be disregarded; for manual assembly operations, on the other hand, there is a consistent decrease in labor per assembly until a certain plateau of efficiency is reached. Thus learning curves have the greatest significance when large amounts of handwork are required.

Usually, learning curves are plotted on log-log paper. Cumulative average labor hours per part are plotted against part quantities. There is a specific reduction in cumulative average labor hours when

part quantities are doubled. This is a geometric progression: one factor varies as the doubled value of the other. If the relationship were plotted on plain graph paper a curved line would result. With log-log paper a straight line results. Straight lines are more satisfactory for plotting purposes since they can be determined by two points or one point and an angle. Also they are easy to interpret.

The information required for developing a learning curve is usually obtained from plant accounting departments. Taking a specific example, cost accounting records for one job showed that 10,000 hours were required to assemble 10 units. Such high labor requirements per unit are not uncommon in the aircraft and electronics industries. The records also disclosed that the cumulative time for the production of 20 units was 16,000 hours; for 40 units it was 25,600 hours; for 80 units it was 40,960 hours. Thus the unit cumulative average (*UCA*) for 10 units was 1000 hours (10,000/10); for 20 units the *UCA* was 800 hours; for 40 units it was 640 hours and for 80 units it was 512 hours. A learning curve for this assembly is shown in *Fig. 1*.

In this example, all of the points fall on a straight line. If the values obtained show a scattering of points, they should be interpolated to give a straight line. Scattering is most common when there is only a small difference between doubled quantities.

The slope of the curve is expressed as a percentage value. Experience has shown that the same or similar types of work will always have the same percentage curve. Knowing the percentage value for a particular type of work, the curve can be plotted with a minimum of information.

Percentages are simply calculated. Where $P =$

*Senior member ASTE Greater New York chapter.

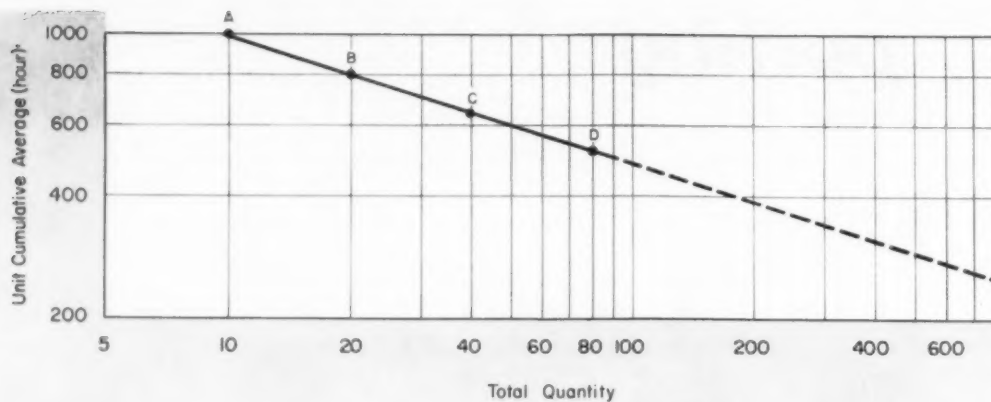
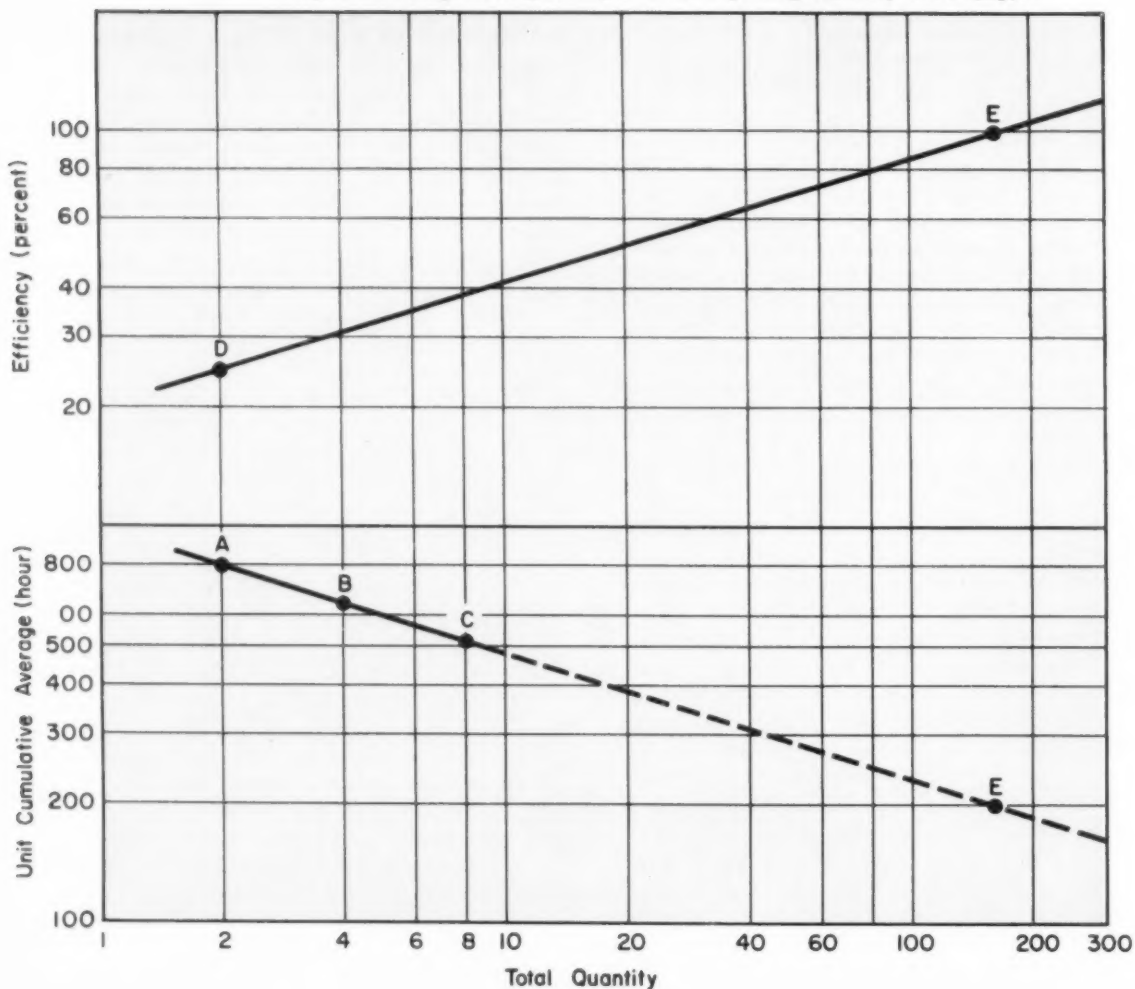


Fig. 1. An 80 percent learning curve, obtained by plotting unit cumulative hours against total quantity.

Fig. 2. Learning curve (bottom) is used in plotting efficiency curve (top).



percentage, A = first quantity of parts, B = UCA hours for quantity A , $C = 2A$ quantity for the run and D = UCA hours for quantity C , $P = D/B$. For the example shown in Fig. 1, $A = 10$, $B = 1000$ hours, $C = 20$ and $D = 800$ hours. $P = 800/1000$ or 80 percent. Knowing the percentage, the learning curve can be extended as shown in Fig. 1. In this case, the UCA for 100 units would be 470 hours.

The 470-hour figure can be converted into dollar cost and a price can be determined for 100 units. Accuracy of the cost depends on the reliability of the information used in plotting the curve. It has been found that values obtained from learning curves are normally within five percent accuracy.

Learning curves must, of course, be plotted for continuous runs. If long periods of time intervene between runs, results will no longer be reliable. Operators may have to relearn the job to some extent; also, due to turnovers in the labor force, at least some of the operators may be new to the job. The UCA cannot be predicted with any certainty in such cases.

When a number of different types of operations are required to manufacture a unit, learning curves are determined for the entire job by evaluating the percentage of the job represented by each operation and by applying the appropriate learning curve for each job. Where X is the percentage of the job represented by each operation and Y is the learning curve for each operation, $P = X_1Y_1 + X_2Y_2 + \dots + X_nY_n$.

The learning curve for automatic screw machines is 100 percent (no labor); for punch press operations it might be 90 percent; for deburring, 80 percent and for assembly, 70 percent. Assuming that these operations represent 40 percent, 10 percent, 20 percent and 30 percent of a typical job, respectively, $P = 0.40(1.0) + 0.10(0.90) + 0.20(0.80) + 0.30(0.70)$, or 86 percent for the job.

It should be noted that the slope of the learning curve is dependent on the amount of labor involved in a job. For automatic work the curve is 100 percent and a horizontal line is obtained. As labor becomes a greater factor, the slope decreases to 80, 70 or 60 percent or even less, thus approaching a vertical position.

Efficiency curves can be developed from learning curves. Efficiency is defined as the ratio between standard or estimated production time and actual production time per unit. An example is shown in Fig. 2. Standard unit time was 200 hours; actual production time was 800 hours per unit for a quantity of two units. Efficiency was $200/800$ or 25 percent. According to the learning curve, 100 percent efficiency ($UCA = 200$ hours) will be obtained with the 160th unit produced. The efficiency curve is drawn from this information. This is the

efficiency rating for the total job and not the efficiency rating for any one piece.

A possible use of learning and efficiency curves is to determine break-even points from the standpoint of labor costs. Data from Fig. 2 can be tabulated as shown in the accompanying table. It is apparent that all units prior to the 45th unit will require more than the standard 200 hours to produce. If there is an incentive plan, labor will be paid straight time up to this point, with the company absorbing the loss. For all pieces after the 45th, incentive will be earned. However, it is not

Tabulation of Data from Fig. 2

Units (No.)	Time for Last Unit (hr)	UCA (hr)	Standard Time (hr)	Efficiency (%)
20	258	380	200	52.6
45	200	295	200	67.5
100	156	230	200	87.0
160	135.6	200	200	100.0
200	124	183	200	109.0

until the 160th unit is produced that the time saved due to workers having learned the job will offset the time lost in learning. For a standard time of 200 hours, the break-even point for the job is 160 units. If only 100 units are to be produced, the standard time should be adjusted to 230 hours. This changes the break-even point to 100 units.

Another possible use of learning and efficiency curves is forecasting the amount of time or units produced it will take an individual to reach a cumulative average of 100 percent efficiency. Records of individual output are often kept for incentive purposes. A worker at 100 percent efficiency will be working at incentive wages. However, the average of his total output at this time will only be equal to the standard time. In Fig. 2, for example, the actual time required to make the 160th unit is 135.5 hours; UCA hours is 200 and efficiency is 100 percent.

In order to determine the time required to make any one unit, the UCA hours for the total quantity at that unit of production is multiplied by a conversion factor, $(n - 1)$. The number n is the log of the learning curve (which is expressed as a percentage) divided by $\log 2$. For an 80 percent learning curve $\log 0.80 = -0.097$; $\log 2 = 0.301$. Thus $n = -0.097/0.301$, or -0.3233 . The conversion factor, $(n - 1) = 0.6777$. For Fig. 2, the time for the 160th piece = 200 hours multiplied by 0.6777, or 135.6 hours.

With this information available, management can determine where on the learning curve a new worker should be in a certain time. Learning ability of an

individual for the type of operation in question can thus be established.

Doubtless other new applications for learning curves are possible. For example, it might prove interesting to make a graph of total cost (including incentive wages) for various quantities, based upon the values obtained from the learning curve.

There are, of course, several present uses of learning curves that pay dividends in increased efficiency. The ability to forecast the production time required for an operation or series of operations makes it possible to estimate the cost of the product much more accurately. In present estimating procedures, the effect of learning is not always taken into account. The more accurate pricing made possible by better estimates gives a company a decided advantage in competitive bidding.

Production schedules and inventories can be controlled more effectively when learning curves are utilized. When a job begins, it is often behind schedule. Normally, this is an indication of trouble. However, the learning period may be the cause of the delay. If so, production will be accelerated as more units are produced. Thus learning curves are an effective tool for determining whether or not

trouble exists. Similarly, learning curves make it possible to more accurately determine the rate at which inventories are created or used and thus forestall troubles caused by depleted inventories of supplies, components or end products.

Learning curves can also be used to schedule manpower. For a given number of units, less manpower will be required as the job progresses. Labor requirements can be accurately predicted for any number of units.

One question is frequently asked about learning curves; it appears that if a job is run long enough, parts will be produced in less than no time. The answer to this question is two-fold. Each company must determine the limitations of the learning curve from its own experiences. Also, quantities increase at a rapid rate from left to right on log-log paper. The quantities on the left-hand third of the graph are 1 to 10; on the middle third they are 10 to 100; and on the right-hand third they are 100 to 1000. At the same time, the UCA hours decrease very slowly. The quantity for zero time will almost never be reached. If, however, the curve is extremely shallow and the quantity for zero time is reached on the chart, experience will dictate the break-off point.

Radiused Thread Root Doubles Fastener Life



Radiused root form reduces stresses.

FASTER FATIGUE LIFE under dynamic loading has been greatly increased by a change in thread form. The new form, used for Unbrako socket head capscrews produced by Standard Pressed Steel Co., has a smoothly radiused root. This greatly reduces failure-producing stress concentrations in a section of a tension screw where 85 percent of fatigue breaks occur—the least cross-section of the thread.

By contrast, the conventional thread root for socket head capscrews and most other industrial fasteners for many years has been a flat root—a truncated V-shape with sharp corners.

As shown by calculations of $\frac{1}{4}$ -28 thread sizes, the stress concentrations in the flat root are as much as six times those in the smooth shank of the stressed screw. The radiused root scales stress concentrations down to a factor of 3.4.

Illustrations at the left are photographs made by passing polarized light through plastic models. Conventional screw thread (top) in form of a truncated V has high stress concentrations in corners, as indicated by many black and white stress lines tightly bunched together. The screw form with the radiused root (bottom) has fewer, smoothly flowing stress lines, indicating a condition that is far less likely to develop fatigue cracks.



CONTROL CHARTS

—key to efficiency

By James H. Greene*

Associate Professor of Industrial Engineering
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Careful timing is essential to meet production deadlines. Simple charts provide the best means of highlighting planned objectives and making sure that those objectives are achieved on the production floor at the proper time.

“PLAN YOUR WORK and work your plan” is a motto in most companies. Without sound planning, it is unlikely that manufacturing operations will be carried out successfully or profitably. Without some form of control it is unlikely that even the soundest plan will be carried out. One of the best devices for maintaining control of plant operations is the Gantt chart. This chart is a simple way of depicting a production plan and showing whether or not that plan is being put into action. Gantt charts are found in practically every production office.

A major advantage of these charts is that they force a plan to be made. This, in itself, is a big step toward more efficient operations. Another advantage is that work planned and work accomplished are

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quickly compared. There is no need to record or remember a wealth of information for comparison purposes. One chart can replace file drawers full of information. Such charts are dynamic, showing a moving picture of plant activities. An added advantage is that anyone can produce a Gantt chart: paper, pencil and ruler are all that are needed.

Charts are a shorthand form of language and if they are to be effective, everyone using them must know the symbols. Many symbols are used and some companies prefer to develop their own. Some typical symbols are shown in *Fig. 1*.

An example of a simple Gantt chart is shown in *Fig. 2*. The chart was brought up to date on Tuesday night, as indicated by the symbol. Order No. 1 was started Monday noon and is to be completed Wednesday night, as illustrated by the light line. The heavy line, which extends beyond the present time, shows that the order is ahead of schedule. Order No. 2 is behind schedule and order No. 3 has not been started.

There are a few basic principles that must be understood before successful charting can be done. The first is that distances along the horizontal axis represent either time or production. For example, one can say that a space between two vertical lines on the charts represents one hour in which fifteen parts are produced or that the space represents fifteen parts that take one hour to produce. The result

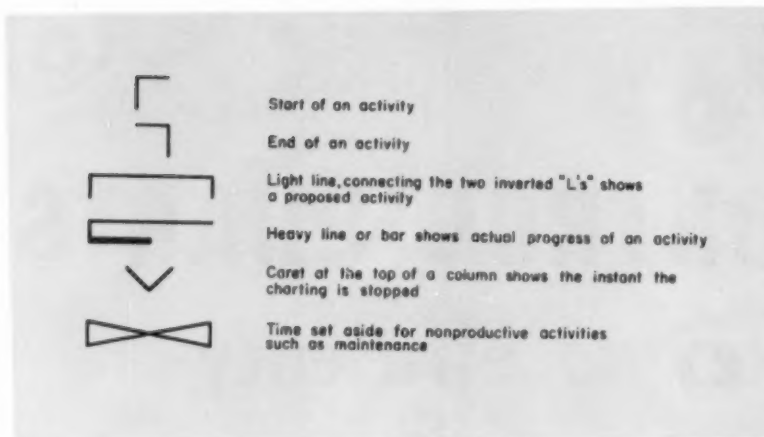


Fig. 1. Typical symbols used for Gantt charts. These symbols can be modified too suit specific applications.

s the same. It should be pointed out that if production standards are in use they will have to be modified by the plant efficiency factor to make them realistic.

Beside the light line representing the proposed production on the sample chart is a dark line that shows the actual progress of production. The difference between the two lines shows how near the production is to completion.

A vertical line drawn through the caret at the top of the chart represents the instant the charting is stopped. The difference between the two lines shows how far ahead or far behind schedule the production is.

Although there are many variations of the Gantt chart it is possible to classify all of them into two basic types. These can be called "Forward" and "Backward" charts. The Forward chart is frequently called a "Schedule" chart and the work is scheduled from the present date forward to determine the completion date. The Backward chart, which is often called a "Project" chart, is used when a completion date is known and it is desired to work backward to find a starting date.

A simple analogy makes the distinction between these charts easier to see. When planning a trip, one can go either by train or by car. The train leaves at a definite time. In this case it is essential to start the planning from the instant the train

leaves and work backward to fit everything into a schedule. This would be charted on a Backward or Project type of chart. If the trip is to be made by car, the traveler can leave at any time. Planning can be started from the present moment and plotted on a Forward or Schedule chart.

There are several important things to consider before attempting to chart any activity. The first question to ask is: "Is it worthwhile?" Preparing charts and keeping them up to date take time and money, so the need for the information given on a chart must be real. Another question is: "Is the required information available?" If the information cannot be obtained, is inaccurate, or is so out of date that no action can be taken, then charts will be useless.

Another consideration that is often forgotten when setting up chart control systems is whether the right type of personnel is available. The individual who keeps up the charts must have a mind for detail and not be overburdened with larger problems. Often a clerk or secretary is best suited to the job.

A chart is dynamic and must be constantly fed information. Once the course of a chart is set, it can never be corrected without feedback of information. This information may take the form of job tickets, time cards, move cards, material requisitions and the like.

Fig. 2. Method of charting the progress of manufacturing orders.

	Manufacturing Orders				
	Monday	Tuesday	Wednesday	Thursday	Friday
Order No. 1	[Progress bar from Monday to Wednesday]				
Order No. 2		[Progress bar from Tuesday to Wednesday]			
Order No. 3			[Progress bar from Wednesday to Friday]		

Fig. 3. Machine schedules are charted on a Forward chart. The objective is to keep the machine fully loaded.

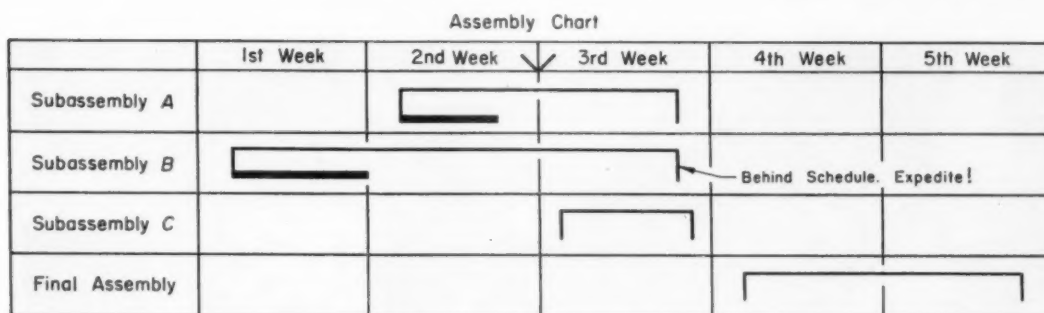
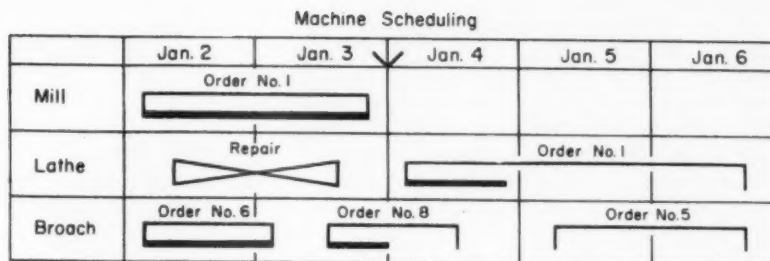


Fig. 4 Assembly schedules usually appear on a Backward chart. Here the objective is to have all component parts ready by the assembly date.

What to chart depends on the circumstances. A good rule to follow is: chart whatever is worthwhile charting and for which data are available. Companies are now planning and controlling workers, work centers, machines, departments, plants, parts, work orders, operations and assembly schedules with simple charts. The example in Fig. 2 showed how this technique could be used for keeping track of orders. Figs. 3 and 4 show how the technique is applied for machine and assembly scheduling.

Machine charts are usually Forward charts. The objective is to keep the machine always loaded. Blank spaces are to be avoided, since they show that the machine is not productive. Assembly charts are usually Backward charts. Here the problem is to keep track of all parts required for an

assembly, making sure that they are ready for assembly on the required date.

The charts described can be drawn on ruled paper with the proper scale. Lines can be drawn with pencil, crayon or ink, although the possibility of erasures should be kept in mind. One technique is to represent the lines with colored tape, cut to length. Several commercial types of Gantt charts are available and should be studied before an installation is made.

Whatever system is used, simple or elaborate, the basic principles discussed in this article should apply. One should be cautious of accepting standardized types of charts. It is much better to design the charting method to suit the problem. If this is done, close control of operations—and adherence to production deadlines—is assured.

American Standard for Bearings

FOR THE FIRST TIME, an American Standard method of evaluating load ratings for ball and roller bearings has been established, providing a uniform capacity rating system for bearings made by all manufacturers.

Published by the American Standards Association, the new American Standard B3.11-1959 is truly international since it is identical in all major technical respects with ISO Recommendation 76 of the International Organization for Standardization covering static testing of bearings and the latest draft proposal covering dynamic testing.

The standard establishes uniform test procedures

and statistical methods for determining load-carrying capacity and expected fatigue life of both ball and roller bearings. It covers dynamic as well as static capacity of radial and thrust type bearings and contains definitions of bearing life, basic load rating, equivalent load, basic static rating, and static equivalent load. It also gives formulas for calculating these for different types and sizes of bearings.

American Standard Method of Evaluating Load Ratings for Ball and Roller Bearings is available at \$1.75 a copy from the American Standards Association, 70 East 45th St., New York 17, N.Y.

ENGINEER ADJUSTS MODEL of special harness designed for testing Bomarc interceptor missile at Boeing Airplane Co. Tests are designed to duplicate as closely as possible actual flight conditions. Components will be electronically monitored to check performance under the pressures, temperatures, sound levels and vibration of actual rocket firing.

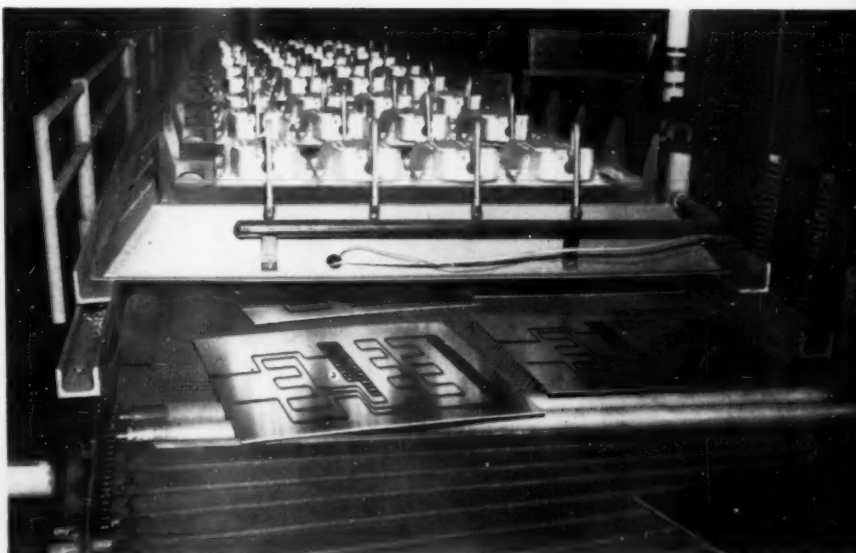


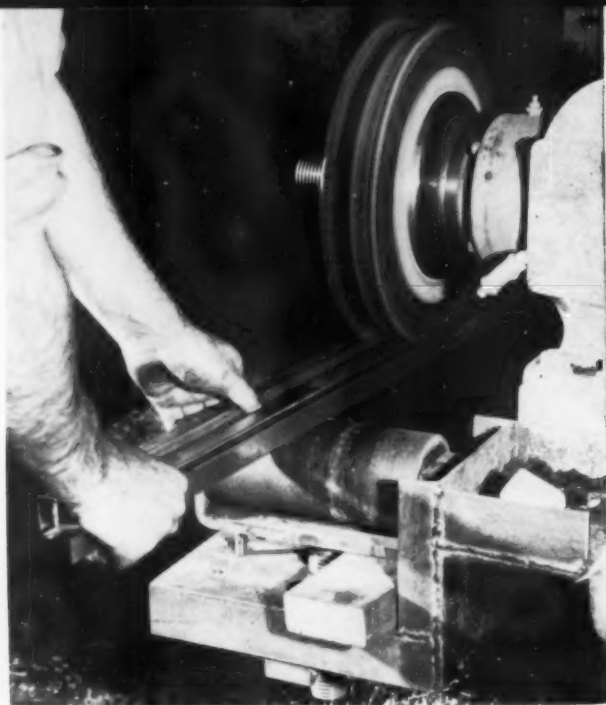
TOOLS at work

CLOSED-CIRCUIT TELEVISION is used for testing transistors at the General Electric Co. Electronics Laboratory. Prior to using the system, engineers were required to look through special microscopes while recording minute electronic pulses and were faced with the possibility of slight X-ray exposure. Image from face of special pulse-measuring oscilloscope tube is magnified on TV monitor screen.



FAST DRYING of metal ink on aluminum sheet is obtained with gas-fired infrared heaters at Reynolds Metals Co., Louisville, Ky. Sheets are bonded together and increased in area in a rolling mill. The ink prevents bonding of the printed surfaces which are expanded into tube circuits by fluid pressure after rolling. Heaters are manufactured by Perfection Industries, Div. of Hupp Corp.



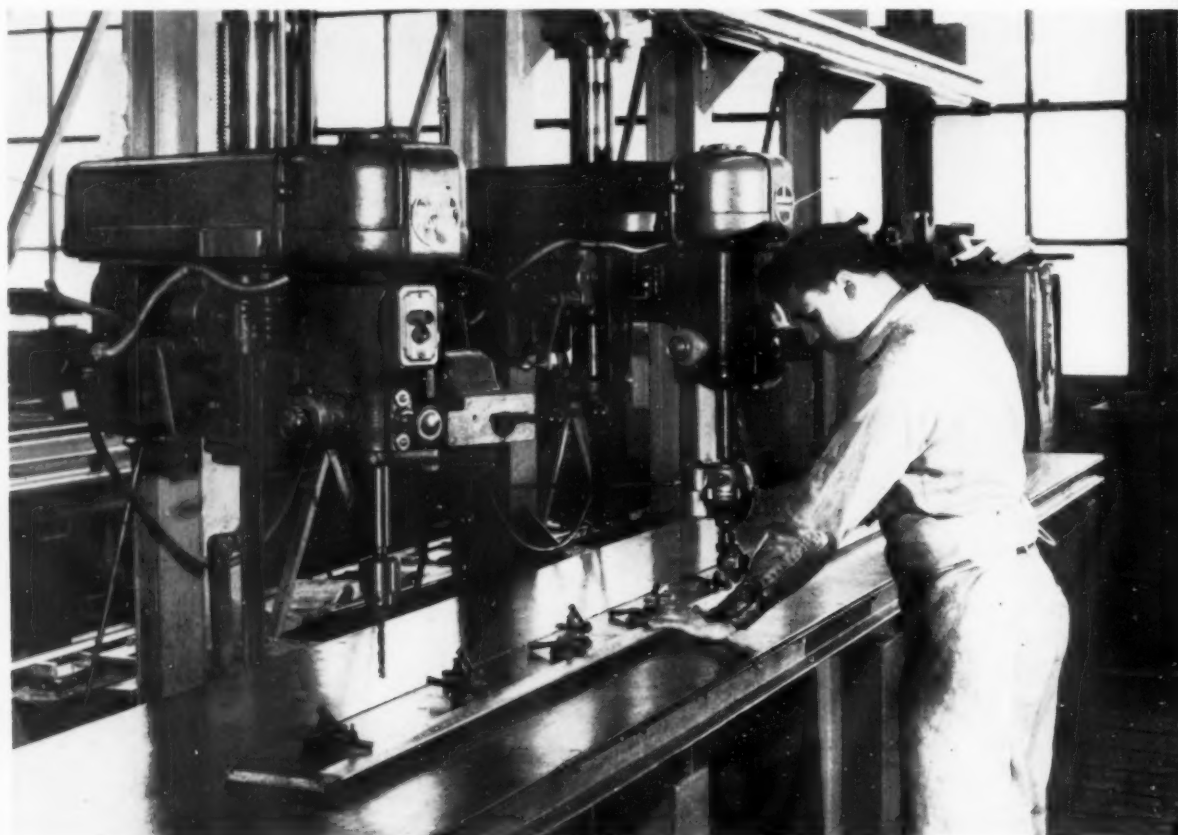


FINISHING GROOVES AND CHANNELS of stainless steel window frames at Flour City Ornamental Iron Co., Minneapolis, disks of nylon web impregnated with fine abrasive mineral conform to the shape of the workpiece. Loading is built up from disks $\frac{1}{4}$ inch thick. Replacing buffing and polishing for some final finishing operations, wheels are not intended for stock removal. Disks are "Scotch-Brite," made by Minnesota Mining & Mfg. Co.

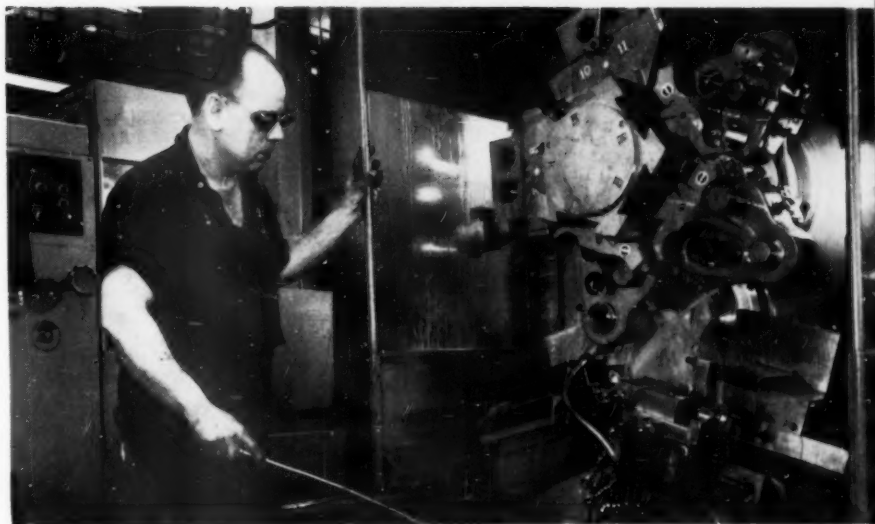
TOOLS at work

TWO WALKER-TURNER overhead drill presses, mounted on a single crane rail, speed the drilling and tapping of long strips at Kidde Textile Mach. Corp.,

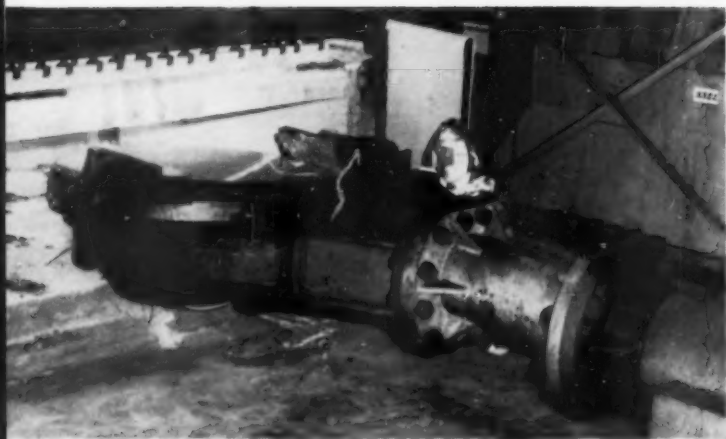
Bloomfield, N.J. The strips, guide bars for knitting machines, are 50 to 200 inches long and have tapped holes an inch apart along their lengths.



FOURTEEN OPERATIONS are completed in six minutes on this pair of Warner & Swasey 2AC chucking automatics used for machining steel valve seats at the Le Roi Div. of Westinghouse Air Brake Co. One automatic chucker machines the initial side of the workpiece; the second machine completes the opposite side.

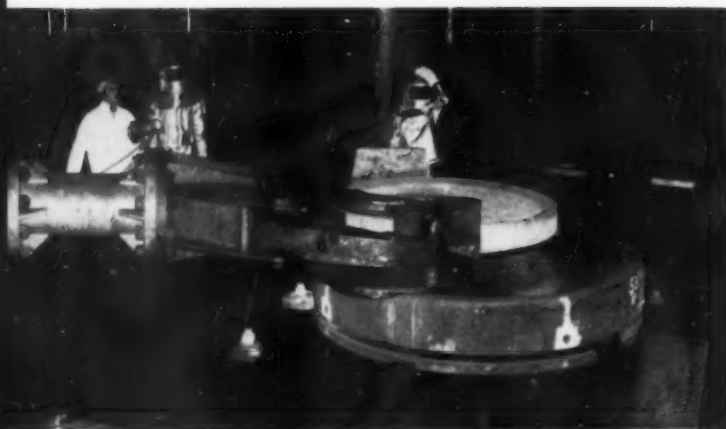


FROM 30 TO 100 HOLES PER MINUTE are pierced with Wiedemann turret punch press. Operator positions stylus in hole on template, automatically positions work under punch, then trips button that actuates ram. Various sizes of punches in the turret are revolved into position as needed, eliminating the necessity of changing punches during production runs. Holes in template are color coded according to size. Punches in turret are also color coded.



STEEL-JACKETED beryllium billet, held in the jaws of a manipulator is removed from furnace. Produced by Brush Beryllium Co., the billet is 62 inches in diameter and five inches thick.

TOOLS at work



BILLET is placed in the die of a 50,000-ton press operated by Alcoa. The beryllium forging is jacketed with steel for high-temperature forging operation.

BERYLLIUM DISK is removed from the die after forging. Finished forging is approximately 80 inches in diameter and three inches thick. For its rare ability among metals to store large amounts of heat beryllium has been selected for testing as a heat sink material for space capsules.



how to calibrate

SMALL SURFACE PLATES

By R. J. Rahn

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Fig. 1. Autocollimator set up directly on a small surface plate to check flatness. Mirror on sine bar is moved to take series of readings.

Dimensional variations as small as five millionths of an inch can be measured with an autocollimator. Such precise results can be obtained only if the instrument is used correctly.

WITH THE DEMAND for ever-increasing precision, laboratory measuring instruments are now being used on the production floor. Autocollimators, for example, can determine angular changes as small as $\frac{1}{5}$ second, making them suitable for checking flatness of surface plates. The sine of $\frac{1}{5}$ second is 0.000001. Using a mirror mounted on a five-inch sine bar, theoretical accuracy of an autocollimator measurement is five millionths of an inch. Such precise results are possible, however, only if the instrument is used correctly. A detailed discussion of surface plate calibration is found in *THE TOOL ENGINEER*, Oct. 1955, p. 85.

For ideal calibration of surface plates, a sine bar mirror and the autocollimator are placed on the surface plate, utilizing a corner mirror as shown in Fig. 1. Readings taken along one diagonal of the surface plate are shown in the second column of TABLE 1. Calculations necessary to determine the deviation from a straight line are

shown in succeeding columns and the actual deviation from flatness, in millionths of an inch, is shown in the last column. This deviation is shown graphically as Curve 1, Fig. 2.

In order to completely calibrate a surface plate, the mirror should be moved over the entire surface, end-to-end and corner-to-corner. The need to reserve an area for the autocollimator may make this difficult, but it is essential on small surface plates, which often must be finished to an even greater degree of precision than larger surface plates. A corner mirror base that straddles one end of the sine bar permits the bar to be moved to the ends and corners of the surface plate. Short autocollimators, obviously, can be used with smaller surface plates than long models.

Some surface plates are so small that even short autocollimators cannot be used. In such cases both the surface plate being calibrated and a support for the autocollimator are mounted on a common rigid base, as shown in Fig. 3. Then the instrument and the surface plate will be fairly stable in relation to each other, but, as will be shown later, not absolutely stable.

The surface plate shown in Fig. 3 is the same plate shown in Fig. 1. It is resting on a 48 x 72 x 10-inch surface plate. Another 24 x 36 x 6-inch

Table 1—Calibration With Autocollimator On Plate

Position of Mirror ^a	Actual Readings (sec.)	Difference from First Reading (sec.)	Cumulative Difference (sec.)	End Adjustment (sec.)	Net Difference (sec.)	Deviation (0.000001 in.)
0	---	---	0.0	0.0	0.0	0.0
5	18.8	0.0	0.0	+0.7	+0.7	+17
10	18.6	0.0	0.0	+1.3	+1.3	+31
15	18.4	-0.4	-0.4	+2.0	+1.6	+39
20	18.3	-0.5	-0.9	+2.6	+1.7	+41
25	18.0	-0.8	-1.7	+3.3	+1.6	+39
30	17.9	-0.9	-2.6	+4.0	+1.4	+34
35	17.7	-1.1	-3.7	+4.6	+0.9	+22
40	17.2	-1.6	-5.3	+5.3	0.0	0.0

^aDistance from reference point, inch.

surface plate is also placed on the larger surface plate to support the autocollimator. Readings taken with this setup are shown in TABLE 2. The deviation shown in the last column is represented graphically by Curve 2, Fig. 2. This curve differs from Curve 1, despite the fact that both represent autocollimator readings taken along the same diagonal on the same surface plate. One must be wrong.

The difference in readings is due to the surface plate tilting in space, relative to the autocollimator. This tilt is caused by shifting the sine bar along the surface of the plate. Although the sine bar and mirror weigh only four pounds, moving this weight along the 500-pound surface plate causes the supporting pads attached to the bottom of the plate to compress and expand slightly. This causes the entire plate to tilt. It should be emphasized that this is definitely a tilt, not a bend.

Another set of readings can be taken to check the tilt. As shown in Fig. 4, the autocollimator is moved to one side so that it receives its image

from a stationary mirror. In this setup, a 10-inch sine bar with mirror is used; however, any length sine bar can be used since the mirror is never moved, relative to the plate.

The five-inch sine bar with mirror is moved along the diagonal in exactly the same steps as before, but no autocollimator readings are taken. Changes in readings taken on the fixed mirror range from 17.0 at position 35 to 14.9 at the zero position, as shown in the third column from the left, TABLE 3.

These readings are subtracted from the combined tilt and plate deviation readings taken previously. The calculated deviation of the surface along the diagonal, in millionths of an inch, is shown in the last column of TABLE 3 and plotted as Curve 3, Fig. 2. Curve 3 is very close to Curve 1; the difference of eight millionths of an inch is due to observational error.

The data in this case were taken under ideal conditions; the surface plate being calibrated and

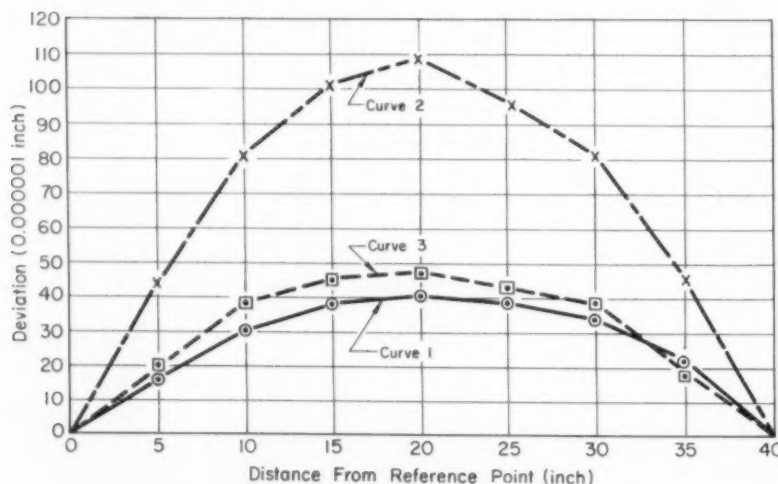


Fig. 2. Curves obtained when calibrating a surface plate with an autocollimator. Curve 1 was obtained with an autocollimator mounted directly on the surface plate being checked; Curve 2 was obtained by using an autocollimator mounted on a second surface plate; Curve 3 is corrected to allow for tilting of the plate being checked.

Table 2—Calibration With Autocollimator Off Plate

Position of Mirror ^a	Actual Readings (sec.)	Difference from First Reading (sec.)	Cumulative Difference (sec.)	End Adjustment (sec.)	Net Difference (sec.)	Deviation (0.000001 in.)
40	---	---	0.0	0.0	0.0	0.0
35	25.2	0.0	0.0	+1.9	+1.9	+46
30	24.7	-0.5	-0.5	+3.9	+3.4	+82
25	23.9	-1.3	-1.8	+5.8	+4.0	+97
20	23.7	-1.5	-3.3	+7.8	+4.5	+109
15	23.0	-2.2	-5.5	+9.7	+4.2	+102
10	22.5	-2.7	-8.2	+11.6	+3.4	+82
5	21.8	-3.4	-11.6	+13.6	+2.0	+44
0	21.3	-3.9	-15.5	+15.5	0.0	0.0

^aDistance from reference point, inch.

the autocollimator base were both on a large, rigid support. If such support is not available and the autocollimator and the surface plate being calibrated are on separate stands, much greater tilt may be expected. The amount of tilt will vary with:

1. Compressibility of the material used for pads under the surface plate
2. Area of the pads in contact with the supporting surface
3. Compressibility of the supporting surface
4. Rigidity of the stand
5. Compressibility of the floor
6. The time rate of compressibility and expansion of all materials affected
7. Relative weight of the surface plate to that of the sine bar and mirror.

There is always a possibility that something may occur to change the tilt of the surface plate or the autocollimator during the interval between taking readings to check flatness and tilt. If extreme accuracy is essential, two autocollimators should be used and readings taken simultaneously on the fixed mirror and the moving mirror at each position. With this precaution, measuring accuracy is extremely high.

Fig. 3. (below) When there is no room for an autocollimator on the surface plate being checked, it can be mounted on a separate stand. Here a small surface plate is used as a stand and both this plate and the plate being checked are mounted on a large surface plate.

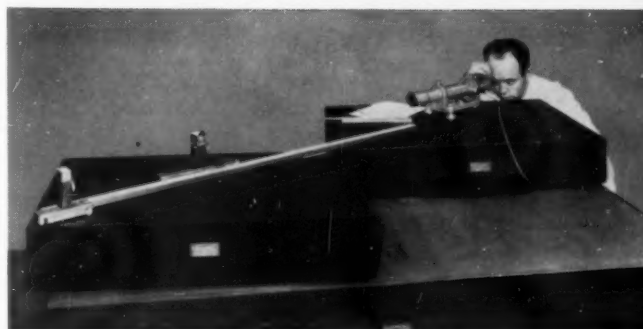
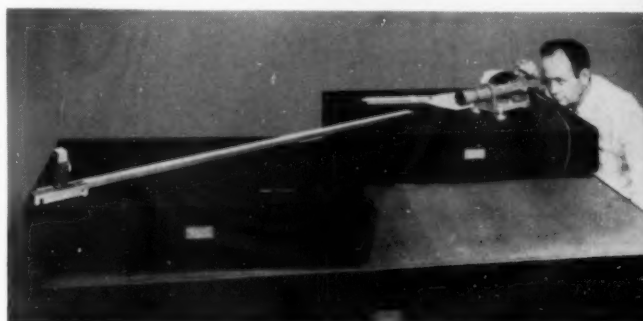


Fig. 4. Tilt is determined by changes in readings on the fixed mirror mounted at the center of the surface plate being checked. Plate tends to tilt as sine bar with mirror is moved along surface.

Table 3—Deviation Corrected for Tilt

Position of Mirror ^a	Readings from Moving Mirror (sec.)	Readings from Fixed Mirror (sec.)	Difference Between Readings (sec.)	Difference from First Reading (sec.)	Cumulative Difference (sec.)	End Adjustment (sec.)	Net Difference (sec.)	Deviation (0.000001 in.)
40	---	---	---	---	0.0	0.0	0.0	0.0
35	25.2	17.0	8.2	---	0.0	+0.8	+0.8	+19
30	24.7	16.6	8.1	-0.1	-0.1	+1.7	+1.6	+39
25	23.9	16.3	7.6	-0.6	-0.7	+2.5	+1.8	+43
20	23.7	16.1	7.6	-0.6	-1.3	+3.3	+2.0	+48
15	23.0	15.7	7.3	-0.9	-2.2	+4.1	+1.9	+46
10	22.5	15.5	7.0	-1.2	-3.4	+5.0	+1.6	+39
5	21.8	15.0	6.8	-1.4	-4.8	+5.8	+1.0	+24
0	21.3	14.9	6.4	-1.8	-6.6	+6.6	0.0	0.0

^aDistance from reference point, inch.

NITRIDING

improves die life

By S. Bergman

**Tool Engineer
F. L. Smithe Machine Co., Inc.
New York, N. Y.**

CHANGING TOOL STEELS does not always solve die life problems. This was the case with four-stage dies used in the production of envelope clasps. For several years, standard tool and die steels were used. The best performance that could be obtained was about 125,000 to 150,000 hits before regrinding.

This performance was considered adequate for the production volumes involved; however, under an accelerated program calling for three to four million parts per day, regrinding of punches and dies and replacement of worn-out tools caused production delays. No improvements were obtained by changing tool materials so a new approach was indicated.

Previously, a drill life problem had been solved by using nitrided drills. Nitriding extended drill

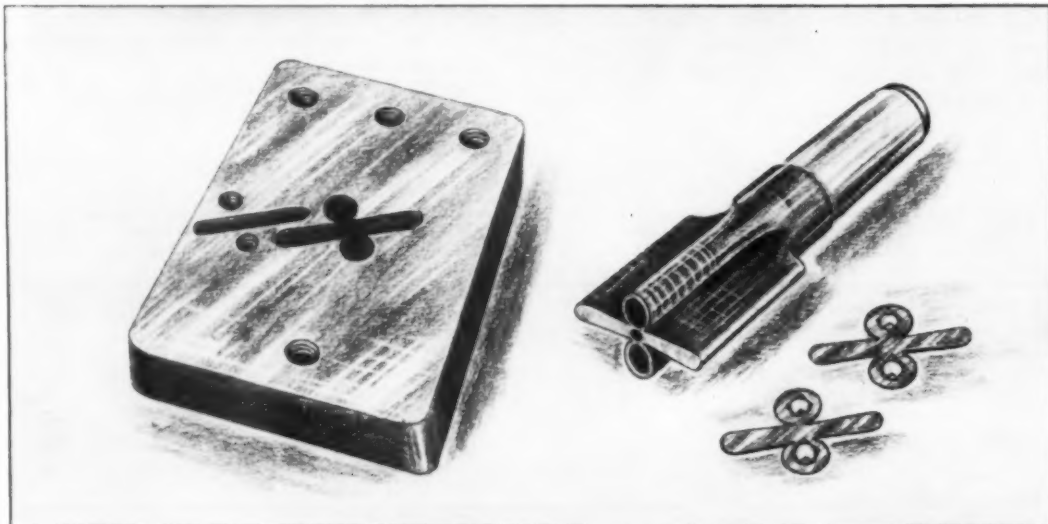
life substantially when machining small holes in bandsaw steel. It was decided that nitriding punch and die components might result in a similar improvement in service life.

A set of punches and dies that was nearly worn out was selected for tests. The components were nitrided to produce a case that was 0.007-inch deep. This case was extremely smooth and slippery and prevented galling or pitting of wear surfaces.

Nitriding was accomplished after the punches and dies were hardened and ground. No distortion occurred and growth of the material was less than 0.0003 inch per inch of thickness. Excess material was easily stoned off. When file tested, the case was almost glass hard.

Tests with the nitrided punch and die showed a substantial increase in life. No cracking or peeling of the nitrided surfaces occurred. Over one million hits were obtained before regrinding was necessary. After one year of production use, records show that die life has been increased by 700 percent, with die maintenance cost reduced a commensurate amount.

Punch and die used for stamping envelope clasps. Punch is approximately one inch across.



multiple machine OPERATIONS

... determining interferences

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Machine downtime is costly because the machines are not working. The authors outline a method for determining and identifying these losses and suggest methods to predict their values.

ANALYSIS OF MACHINE INTERFERENCE, commonly known as downtime, can improve machine utilization in most multimachine operations. If no interferences occurred, machine utilization which is the ratio of machine running time to total elapsed time would be 100 percent. However, interferences do occur during setup, tool care, material loading and machine adjustment as well as from losses for personal needs of the operator. The problem is not only to identify the cases of the interferences, but rather to determine them in such a way that the operating conditions under varying circumstances are correctly reflected.

In the process of interference determination, analysis often shows that revisions in operating methods will permit substantial improvement in machine utilization. The optimum in machine

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utilization under practical factory conditions will be approached when machine interferences are known so well that allowances can be made during a work shift as conditions change.

Mathematical methods are an important part of this analysis. However, careful observation of the machines operating under various conditions should not be neglected. For example, determining tool care and miscellaneous delays, often performed by work sampling studies, ignores the important fact that lost time due to tool care is related to the type of tools being used and the materials being cut. This approach also ignores the fact that miscellaneous delays are of two types: cyclical delays that occur regularly as for material loading and noncyclical delays that occur in a random pattern due to machine breakdowns, tool adjustment or machine adjustment.

In addition to the mathematical analysis, logical steps must be taken to determine the interferences that are apt to occur in multimachine operations. These are:

1. Observation of shop methods
2. Recording of observed data.

Detailed time studies must be made of the setup and operating methods. This information is needed to determine whether the men should be assigned

MULTIMACHINE TIME STUDY

MACHINE NO. 503A			1043			1042			505			781		
PART NO. 567A			41B			67C			529A			48B		
CYCLE (MINUTES) 77			150			120			30.0			20.0		
ELEMENT	SUBT	READ	ELEMENT	SUBT	READ	ELEMENT	SUBT	READ	ELEMENT	SUBT	READ	ELEMENT	SUBT	READ
EMPTY LOAD	90	0.00	RUN OUT LOAD	90	2.20	RUNOUT LOAD	95	4.80				RUNOUT LOAD	90	6.00
RUNOUT LOAD	70	8.60			3.10			5.15					90	6.90
RUNOUT LOAD	100	9.30												
RUNOUT LOAD	100	16.00	RUNOUT LOAD	100	18.10	RUNOUT		17.75						
		17.00			19.10	IDLE LOAD	140	19.15						
							90	20.05						
RUNOUT LOAD	95	24.10										RUNOUT LOAD	100	26.90
RUNOUT LOAD	90	25.65	RUNOUT		34.10	RUNOUT LOAD	95	32.05						27.90
		33.35						33.05						
RUNOUT LOAD	90	34.25	IDLE LOAD	20	34.30									
				65	34.95	RUNOUT LOAD	80	45.00	RUNOUT LOAD	90	40.50			
RUNOUT LOAD	95	41.95						45.80						
RUNOUT		42.90	RUNOUT LOAD	90	49.95							RUNOUT LOAD	95	41.90
		50.60			50.85									48.85
IDLE LOAD	35	50.95												
LOAD	75	51.70												
RUNOUT		58.40				RUNOUT LOAD	85	57.80						
								58.65						
IDLE LOAD	30	58.70												
LOAD	95	59.65												
RUNOUT LOAD	95	67.35	RUNOUT LOAD	95	65.95	RUNOUT	95	70.65	RUNOUT		71.40	RUNOUT LOAD	95	68.85
		68.30			66.80	LOAD		71.60						69.80
RUNOUT LOAD	100	76.08							IDLE LOAD	30	71.70			
		77.08								95	72.65			
RUNOUT LOAD	90	84.70	RUNOUT LOAD	75	81.80	RUNOUT	95	83.60				RUNOUT LOAD	90	89.80
		85.60			82.55	LOAD		84.55						90.70
RUNOUT LOAD	85	93.30												
		94.15	RUNOUT LOAD	95	97.55	RUNOUT LOAD	95	96.55	STOP & ADJ. BOX TOOL	275	99.00	STOP & CLEAR CHIPS	120	103.00
STOP & ADJ. FRONT PORTION	225	95.40			98.50			97.50			101.75			104.20
RUNOUT		104.10												
IDLE LOAD	20	104.30				RUNOUT LOAD	100	105.50	RUNOUT		105.40			
LOAD	90	105.70						110.50			108.40			
RUNOUT LOAD	90	112.90	RUNOUT		113.80							RUNOUT LOAD	90	111.90
		113.80	IDLE											112.80

OBSERVER RJBDATE 1/6/58

Fig. 1. Multimachine time study form for gathering data on automatic screw machine operation. Operations and interferences are identified and recorded with the time of each occurrence.

to both set up and operate the machines or whether they should be employed to set up only and operate only. Detailed information will also pinpoint malfunctioning equipment.

If the shop conditions are such that the equipment cannot be immediately corrected, allowances should be made for delays due to this cause. Later, such allowances can be modified if new or corrected equipment is installed. It should be stressed that delays due to malfunctioning equipment listed simply as "delay" or "downtime" and lumped together with other delays for substitution in a mathematical formula are destroying the usefulness of this analysis tool.

Handling of raw materials and tools must also be studied. Are tools brought out to the setup man in kits with all the necessary tools in good working order? Does the setup man recondition the tools or is this done in a centralized tool control crib? What is even more important, do all the setup men perform their jobs in a similar way? Differences

in methods due to operator preference cannot be reflected in allowances for interferences to be applied across the board.

Data obtained from observing five machines operating as a group are illustrated in Fig. 1. This is a collection of all the work elements observed and the time taken for each. Information obtained in this way can be evaluated better when it is posted to a "spread sheet" or "comparison sheet" as shown in Fig. 2. The various elements can then be identified such as working time internal while a machine is operating and working time external while a machine is idle. Interferences are then separated into cyclical and noncyclical.

A comparison sheet is needed for each type of machine grouping. This analysis shows the work elements and elapsed times when an operator is running three machines; when running four machines; when running three machines and setting up the fourth machine; and the other operating condition in the particular machine grouping.

TIME STUDY SPREAD SHEET								
OPERATION <u>Operating Only - 5 Machines</u>					SHEET _____ OF _____			
PRODUCT <u>Automatic Screw Machines</u>								
EQUIPMENT <u>Automatic Screw Machines</u>					COMPILED BY <u>S. J. K.</u>			
REMARKS	TIME STUDY NO.		1	1	1	1	1	
	MACH. NO.		503A	1063	1042	505	781	
	PART NO.		567A	41B	67C	529A	48B	
	MATERIAL		BRASS	1020	BRASS	4120	1113X	
	BAR CYCLE-MIN		7.7	15.0	12.0	30.0	20.0	
	TOTAL TIME		480.0	480.0	480.0	480.0	480.0	
NO. UNITS MADE		10,000	5250	6400	2000	3500		
DATE		1-6-58						
ELEMENT	DESCRIPTION	GRAPH NUMBER	SELECT NORMAL	TIME	TIME	TIME	TIME	TIME
1	LOADING TIME			45.0	27.0	28.0	14.0	20.0
2								
3	MACHINE EMPTY-WAITING			15.0	8.0	9.6	3.5	5.0
4								
5	MACH. DOWN MECHANICAL			4.0	8.0	0	5.4	0
6								
7	MISCEL. DELAYS			8.0	3.5	4.6	1.2	7.8
8								
9	START UP TIME			4.6	3.2	2.7	5.3	5.9
10	FINISH UP TIME			1.2	1.1	1.0	2.4	4.9
11	PERSONAL			5.4	4.6	1.2	0.6	4.8
12								
13	TOOL CARE MACH. DOWN - FROM C'S					0	8.7	5.8
14	" CUT OFF			0	3.3	2.5	4.1	0.4
15	" DRILL			0	6.9	3.4	5.6	4.0
16	" REAM			3.6	2.8			7.2
17	" TAP							
18	" THREAD					0		
19	" SPOT-CENTER			2.9				8.3
20	" KNER			0	1.8	0	0	
21	" BOX				4.8			5.9
22	" MILL			5.9		4.6	7.8	
23	" DRILL							
24	" KNER							
25	" BOX							
26	" CHAMF. BEVEL			0	0	0.4	1.4	0
27								
28								
29	RUNNING TIME			385.0	405.0	420.0	420.0	400.0
30								

Fig. 2. Analysis sheet for the determination of the spread of time studies on the five machines in Fig. 1. Elements are grouped by operations and delays in production are listed for each machine.

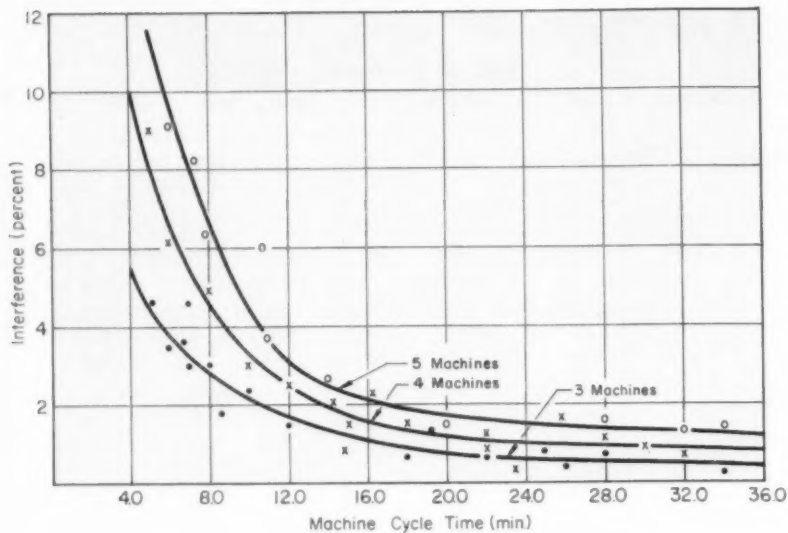


Fig. 3. Curves for finding the percent of interference for a known machine cycle time. The chart is based on the condition of the operator running the machine without doing setup.

PERCENT TOOL CARE						PART NAME		PART NO.	
TOOLS	MATERIAL			NO	SUB TOTAL	TYPE MACHINE	OPERATOR NO.		
	BRASS-ALUM	STEEL	MONEL-STAIN						
Form	.80	.90	1.00			PIECE CYCLE	MATERIAL		
Cutoff	.10	.60	.80			PIECE LENGTH	BAR CYCLE		
Drills	.20	.25	.30			BAR LENGTH			
Ream	.10	.20	.30			PIECES PER BAR			
Thread	1.00	1.30	1.50			LOADING TIME PER BAR			
Taps	.40	.70	1.00			LOADING TIME PER PIECE			
Mills & Attachments	.20	.40	.60			TOTAL TIME PER PIECE			
Knee & Box Tools	.50	.90	1.20			PERCENT INTERFERENCE Operating Only			
TOTAL PERCENTAGE									
CALCULATION OF STANDARD Operating Only						BAR CYCLE	PER MACHINE—PERCENT		
							1 MACHINE RATE	2 MACHINE RATE	
						6.0	4.0	7.0	
						7.0	3.2	5.5	
TOTAL TIME PER PIECE						8.0	2.8	5.0	
PERSONAL %						10.0	2.3	3.8	
TOOL CARE %						12.0	2.0	2.5	
INTERFERENCE %						14.0	1.5	2.0	
MISCELLANEOUS %						18.0	.9	1.4	
TOTAL PROD. MINS.						22.0	.7	1.2	
ADD 2% BONUS						26.0	.6	1.0	
TOTAL STD. MINS.						30.0	.5	.9	
STD. HRS. PER 100 PCS.						36.0	.4	.8	

Fig. 4. Summary work sheet for recording time delays so that a standard can be determined. The table in the right-hand corner shows the percent interference for different bar cycles.

Charting the machine cycle time versus the interference for three, four, and five machines is shown in Fig. 3. This is for operating the machines only; no setup is involved.

A work sheet, Fig. 4, summarizes various delay times. At the lower left-hand corner of this form, the tabular representation of the interference is on the basis of three, four, and five machines being operated with various bar cycle times. Bar cycle time refers to the amount of time required to machine a bar of material at a given machine cycle time under normal conditions.

A typical setup work sheet, having all of the setup time elements with the required times, is shown in Fig. 5. These are the base times required to set up and tear down an automatic screw machine. Base times must be increased by the interference factors incurred when a setup is being made. Interference allowances, in turn, change with the number of machines and bar cycle times.

Unfortunately, interferences do not remain fixed unless the machine grouping and bar cycle times are always the same. It is clear that the interference is greater for setups with short bar cycle times than for setups with long bar cycle times. Tables for the determination of percent interferences can be constructed for changes of these

Percent Interference Allowance*

(to be added to base setup time)

First Machine Cycle (min)	Second Machine Cycle (min)									
	6.0	7.0	8.0	10.0	12.0	15.0	20.0	25.0	30.0	Interference (percent)
6.0	19.4	18.1	17.0	15.0	14.0	13.3	12.6	12.5	12.4	
7.0	18.1	17.0	16.0	14.0	13.5	12.8	12.1	12.0	11.9	
8.0	17.0	16.0	14.8	12.6	12.2	11.3	10.6	10.4	10.3	
10.0	15.0	14.0	12.6	10.2	9.2	8.1	7.1	6.9	6.8	
12.0	14.0	13.5	12.2	9.2	8.6	7.4	6.0	5.5	5.2	
15.0	13.3	12.8	11.3	8.1	7.4	7.1	5.6	5.0	4.7	
20.0	12.6	12.1	10.6	7.1	6.0	5.6	5.0	4.5	4.2	
25.0	12.5	12.0	10.4	6.9	5.5	5.0	4.5	4.2	4.0	
30.0	12.4	11.9	10.3	6.8	5.2	4.7	4.2	4.1	3.6	
35.0	12.2	11.8	10.2	6.7	5.0	4.5	4.0	3.8	3.5	
40.0	12.1	11.6	10.1	6.5	4.9	4.4	3.9	3.7	3.4	
45.0	12.0	11.5	10.0	6.4	4.8	4.3	3.8	3.6	3.3	
50.0	11.9	11.4	9.9	6.3	4.7	4.2	3.7	3.5	3.2	
55.0	11.8	11.3	9.8	6.2	4.6	4.1	3.6	3.4	3.1	
60.0	11.7	11.2	9.7	6.1	4.5	4.0	3.5	3.3	3.0	

*Running two machines and setting up third machine.

Fig. 5. (below) A typical setup and tear-down work sheet with minimum time standards for screw machine operations.

AUTOMATIC SCREW MACHINE STANDARDS									
SET UP				TEAR DOWN					
ELEMENTS	STD MIN	FREQ	TOTAL	ELEMENTS	STD MIN	FREQ	TOTAL		
Setup Constant - per Job			21.30	Tear Down Constant			3.40		
Place Tool in Turret - per Tool	.65			Remove Turret Tool	.60				
Cutting Tool Constant - per Tool	1.25			Remove Cross Slide Tool	1.15				
Place Tool in Cross Slide	.70			Remove Vert. Cutoff & Gun	1.70				
Place Saw in Slotter	1.75			Remove Swing Stop	.70				
Change High-Speed Gears	1.75			Remove Bush from P.U. Arm	.35				
Change Low-Speed Gears	2.25			Remove Carriers	1.75				
Change Cycle Gears	2.15			Remove Milling Attachment	2.50				
Assem. Lead & Cross Slide Gears	2.10			Remove Cross Drill & Attach.	2.40				
Set Low-Speed Trip Dogs	2.15			Remove C.S. & Lead Gears	2.50				
Set Spindle Brake Trip Dogs	1.15			Remove Collet & Feed Tube	2.65				
Assem. Chasers & Adj. Die Head	2.45			Remove Chute Feed	1.25				
Assem. & Adj. Vert. Cutoff	2.25			Clear Tools & Return	4.20				
Assem. Bush & Adj Pickup Arm	2.75								
Assem. Cross Drill & Adj.	2.50								
Assem. & Adj. Feed Chute to C. S.	7.90								
Adj. Turret Tools - Drills - Reamers									
Set to Stop	7.00								
Set to Thru	.75								
Adj. Straight Knurl	1.50								
Adj. Box Tool	2.50								
Adj. Recess Tool	2.70								
Adj. Stock Stop	2.25								
Adj. Cutoff	1.75								
Adj. Turret Mill	7.25								
Adj. Thread Roll	2.70								
Adj. C.S. Form - See Table 3A									
Add Two Mach. Cycles to Each Adjust Time									
TOTAL SETUP TIME				TOTAL TEAR DOWN TIME					
				CALCULATION OF STANDARD				SET UP	TEAR DOWN
				TOTAL TIME					
				PERSONAL %					
				MISCELLANEOUS %					
				TOTAL PROG. MINS.					
				ADD 25% BONUS					
				TOTAL STANDARD MINS.					
				TOTAL STANDARD HRS.					
				COMPUTED BY				DATE	

STANDARD DATA WORK SHEET - SETUP Fellows Gear Shaper

PART NAME				PART NUMBER	
OPERATION DESCRIPTION				OPERATION NUMBER	
CUTTER NO.				MACHINE NUMBER	
ELEMENT DESCRIPTION	MIN.	FREQ.	TOTAL	TABLE I. REMOVE CUTTER, GET NEW - INSTALL & ADJ. CUTTER	
Remove, Get & Replace Feed Gears			3.50	ALLOWED VARIATION	MIN.
Remove, Get & Replace Change Gears			5.40	.0010	10.70
Set Lower Worm Shaft	.95			.0015	9.30
Set Hydraulic Stabilizer			1.50	.0020	7.90
Set Crank Arm			3.26	.0025	6.50
Set & Adjust Stroke 1/8" or less Clearance	6.20			.0030	5.10
" " " Unrestricted	4.25			.0035 or up	3.75
Replace Feed Cam	10.95			TABLE II. REMOVE FIXTURE, ADJUST, REPLACE & ADJUST CONCENTRICITY	
Set Depth of Cut	4.02			METHOD OF ADJUSTMENT	MIN.
Change Reciprocating Speed	.85			DIAL INDICATE FIXTURE O.D.	11.69
Set Feed Cam	3.90			DIAL INDICATE FIXTURE I.D.	
Get Units - El Fts., Gages, Fixtures - Crib	1.00			.0015" OR MORE	18.25
To Crib & Return - Dept. A	1.85			DIAL INDICATE FIXTURE I.D.	21.25
" " " Dept. B	1.00			LESS THAN .0015"	
To Inspector & Back	.50			CALCULATION OF STANDARD	
Aside Units, Get - From Shelf	.50			TOTAL ALLOWED MINUTES	
Remove & Replace Base Plates - per Plate	2.50			ADD % MISC. ALLOWANCE	
Get New Base Plates - per Plate	.50			TOTAL PRODUCTIVE MINUTES	
Set Timing Mechanism	.45			ADD 25% BONUS ALLOW.	
Constant - Set Up	8.40		8.40	TOTAL STANDARD MIN.	
Remove Cutter, Get New Cutter & Install TABLE I				TOTAL STANDARD HOURS	
Remove Fixture - Replace - Adjust TABLE II					
Machine Cutting Time - From Cutting Std. Data					
Machine Handling - Allow Base Time					
Machine Interference - Running 1 Mach- TABLE III					
" " " " 2 Mach- TABLE IV					
TOTAL ALLOWED MINUTES					

Fig. 6. Standard data work sheet for the setup and operation of a gear shaper. Element descriptions and allowed variations from standard are included for conditions normally found in production.

allowances based on the operating conditions. The accompanying table shows the conditions for operating two machines while setting up the third. These changes in interference allowances are applicable even when the work is performed on a wage incentive basis.

All of the foregoing information applies to operation of automatic screw machines. A work sheet for the determination of setup time for a gear shaper is shown in Fig. 6. Running times and interference allowances are determined in much the same way as those for the production setups on automatic screw machine.

The weakness in attempting to apply mathematical formulas to work performed in the factory is the exception that occurs so regularly that it must be provided for. When operators are responsible for setup and operation of multimachines, a "jam up" which requires replacement of broken or damaged tools is often used as an excuse to let production drop to an unwarranted low level.

When the time values for the various work and setup elements are available in detail, a "jam up" can be handled without loss of time in excess of the permissible amount. A foreman or his assistant can use the time values provided on the work sheets to establish a time allowance for repairing the "jam up." Interference allowances are added to the base time as before depending upon the bar cycle time and the number of machines operating.

It has been found that these methods are effective for the establishment of all the time data required for the complete control of work performed on multimachine arrangements. Formulas serve a limited use in practical shop setups. Each job is worthy of a detailed analysis. Generalized formulas will not tell the analyst the many things needed to do a thorough job in determining multimachine interferences. The practice of determining as much detail as possible about every factor in a given multimachine operation by actual observation is worthwhile to facilitate analysis.

Comparison Tool Test saves time

By Roy Mennell*

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To reduce the cost of tool testing, a simplified method determines the minimum number of tests required. Calculations are quickly made with a nomograph and a chart. Sample testing problems are included which illustrate the simplicity and usefulness of the method.

PRODUCTION AND MACHINABILITY PROBLEMS of "which is the better" type frequently involve critical analysis. Selections of the better of two tool compositions, two tool geometries, or two sets of machining conditions are examples. While these problems are commonly encountered, no acceptable standard method is available for their solution. In practice conclusions are often based on insufficient evidence or are unsubstantiated by statistics.

Data Variability: One problem involves data variability. Even under laboratory conditions with careful tool grinding and stringently controlled cutting conditions, test results have inherent variability. Some significant variable may not be detected and thus not controlled or another variable may cause scatter in the data even when it has been controlled to the "convenient or economically feasible" limit.

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Production data of course has more scatter. Often, the investigator will not attempt to reduce the variability to avoid biasing results or obtaining an incomplete or unrealistic picture of the process. A statistical technique becomes necessary to properly evaluate this inherent data variability. In addition, at the completion of testing, a statistical technique gives the investigator a measure of confidence in his results. He can state with a degree of precision the probability of his decision being correct.

Number of Tests: The problem is further complicated by the fact that there is no really useful way to determine how many tests should be run to reach a decision with the desired confidence without testing and calculating. In comparing the untried, there is no available evidence of data variability or of the difference in tool life. Both these measurements are necessary in deciding the correct number of tests. When one tool or one geometry or one set of machining conditions has been used in production some of the needed information is available. In this case the investigator might decide the untested condition or tool will produce about the same scatter as the one already used. While the assumption itself may be unwarranted, another piece of information remains missing. The difference in tool life between the old and the new is also necessary to select the number of tests.

If the cost of additional data were small, the correct number of tests would be academic. The investigator would simply take a large number of tests to insure to his satisfaction that he would have enough data to reach a decision. This, however, is not characteristically the case. In laboratory or in exploratory testing the cost of additional machining time and tools must be considered. When it is re-

membered that carbide tool life near the economic machining conditions may vary at least between ten and sixty minutes, it is obvious that the additional cost of running unnecessary pairs of tests is high. An accelerated technique to reduce testing time usually should not be used to obtain the test data because of possible inaccuracy or the extensive testing required to verify its validity.¹

Some production testing may be done with little cost when normal production is not seriously altered. The costs of excessive testing become less obvious but nonetheless real. Testing time means time lost in applying results and it also means loss of the investigator's time that could otherwise be used to solve other problems.

It can be concluded that data must be examined during testing to determine whether sufficient evidence is available to reach a decision. This examination should be made by some statistical technique. Many statistical methods, however, require numerous calculations and so consume valuable time. If the particular statistical method cannot be applied rapidly, its value will be mitigated possibly to the extent of costing more than performing additional testing.

¹ Numerals refer to references listed at end of article.

One method for performing the comparison type of machining test will be discussed. This statistical technique is rapid to apply and a statistically significant decision can be reached with minimum testing at a low cost.

Design of the Statistical Test

A statistical test can be used to determine whether a significant difference exists between two samples. This determination is made by comparing the observed difference in sample means with that which would be expected to occur by chance. If the difference in sample means is greater than some appropriate probability of chance occurrence, this difference is significant. The level of significance is then denoted by the appropriate probability of chance occurrence. For instance if the appropriate probability of chance occurrence had been selected as 0.10 and the difference in the observed sample means was greater than a difference which would be obtained or exceeded 10 percent of the time by chance, it would be concluded that there was a real difference in sample means to the 0.10 confidence level. Or stated another way, it would be correct to decide there is a real difference in samples at least

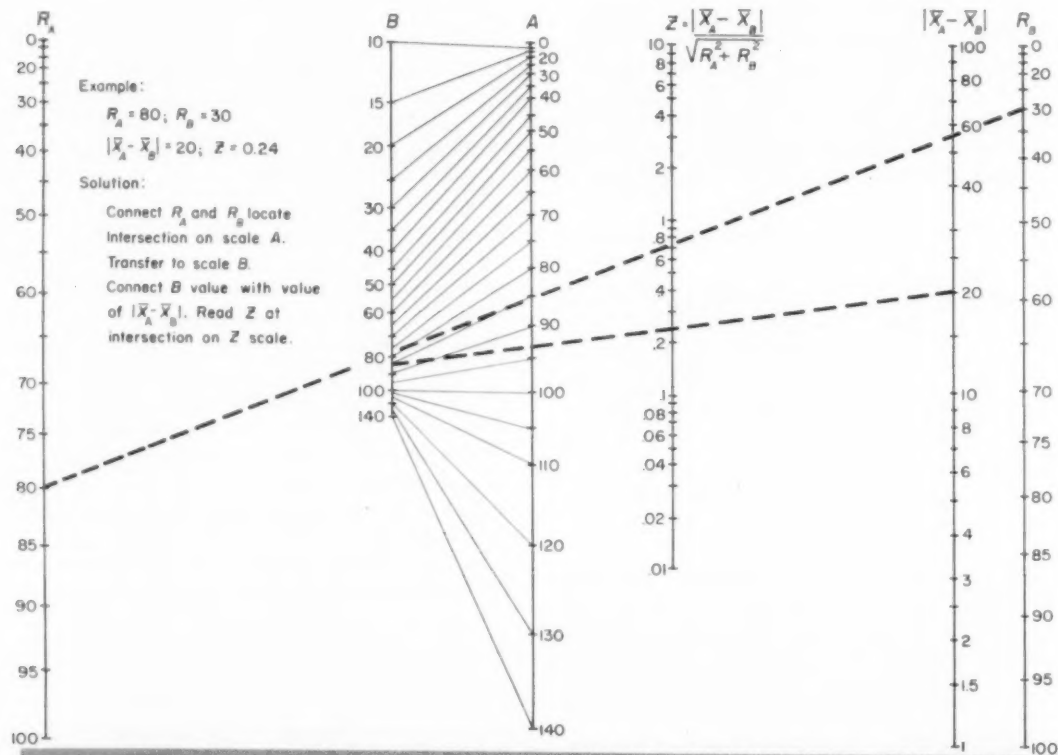


Fig. 1. Nomograph for Z. For data outside the range of values shown, to fit the nomograph all data may be multiplied or divided by a constant.

90 percent of the time. Similar analysis can be used to determine whether the sample means represent the same population.

The appropriate probability, theoretically, should be determined on a basis of economics by selecting a sample size which minimizes the total cost of the experiment. Included in the total cost should be consideration of the cost of arriving at an incorrect conclusion as well as the cost of taking an increasing number of samples and interpreting the data. These relationships are difficult or impossible to obtain in practice, and the confidence level is usually determined informally. If the expense of increasing the sample size is large, high confidence may not be justified. On the other hand, if the consequence of being in error is costly, a high confidence level will be needed. A commonly selected confidence level is the 0.05 level.

The difference in sample means will be distributed according to the Student's t for small samples ($n < 30$). The statistic t is defined as the difference in sample means divided by the standard error of mean. The divisor represents the pooled standard deviation of differences between sample means. This value translates the differences between sample means into standard deviation units of the population. The population in this case is one composed of sample differences. Its standard deviation is estimated by assuming that there is no difference between the means of the populations from which the samples were taken.² Substituting the appropriate symbols

$$t_{AB} = \frac{|\bar{X}_A - \bar{X}_B|}{\sqrt{\frac{S_A^2}{n_A} + \frac{S_B^2}{n_B}}}$$

where \bar{X}_A and \bar{X}_B are the sample means and the terms in the denominator are the best estimates of the variance of each of the sample means. The variance of sample means can be obtained from the population variance of which an estimate from the sample variance (S_X^2) is available. The relationship is

$$S_X^2 = \frac{S_x^2}{n}$$

where n is the size of the sample. Substituting, t_{AB} becomes

$$\sqrt{\frac{|\bar{X}_A - \bar{X}_B|}{\frac{S_A^2}{n_A} + \frac{S_B^2}{n_B}}}$$

when n_A equals n_B ,

$$t_{AB} = \frac{|\bar{X}_A - \bar{X}_B|}{\sqrt{\frac{S_A^2 + S_B^2}{n}}} \sqrt{n}$$

Because the sample variance depends on summing the square of a difference for each item in the

sample, a method was selected for obtaining the same result with less effort. The range (difference between the values of the extreme items in a sample) is often used to estimate the standard deviation to reduce the number of computations. The drawback, however, is that some accuracy is lost and results may be biased if the sample size is large. To avoid biasing the test, it is recommended that the sample be less than twenty.³ A correction to the usual calculation of the range has been made for samples above ten based on the mean of sub-samples.⁴ In the present situation it was decided to use the range where a useful sample size is usually less than a value which would require correction.

The range (R) divided by a constant³ (d_2 , which depends on sample size) equals the expected value of the standard deviation of the parent population

$$\frac{R}{d_2} = S_X$$

In this case d_2 is the same for both samples. The final form of t which is used is

$$t_{AB} = \frac{|\bar{X}_A - \bar{X}_B| d_2 \sqrt{n}}{\sqrt{R_A^2 + R_B^2}}$$

To obtain the value of t from tables at a specific confidence level the degrees of freedom of t_{AB} must be known. Where no assumption is made as to the equality of population variances, the degrees of freedom is one less than the sample size or the number of pairs of tests minus one. A more sensitive test can be made if the variances can be assumed equal. However, in the present situation the added computation to substantiate this hypothesis outweighs any gain in sensitivity.

To eliminate the actual calculation of the t statistic and the reference to tables of the t distribution to determine significance, a nomograph, Fig. 1, and chart, Fig. 2, are used. The nomograph, designed by E. A. Jeffrey, gives the value of

$$Z = \frac{|\bar{X}_A - \bar{X}_B|}{\sqrt{\frac{R_A^2 + R_B^2}{n}}}$$

and the curve, based on specific values of d_2 and the t distribution gives significance directly as a function of sample size.

It is intended that initial testing should consist of three tests of each item. If analysis does not reveal significance at the appropriate confidence level, the sample size should be increased by multiples of one until a significant decision is attained. In most cases a standard Student's t test is justified upon test completion to verify the results. If significance is still not attained after twelve pairs of tests, the technique should not be continued. The investigator may decide more testing is warranted

and in this case the economics of the particular situation would also support the use of the standard t test^{3,6}.

Use of the Statistical Test

To determine if a significant difference exists in the average results of tests on each of two items, a practical method was prepared to implement the use of the statistical analysis described. This method requires a minimum of calculation and can be applied rapidly:

1. Perform three tests on each item (the results of tests on an item constitute a sample).
2. Observe the range and calculate the mean of each sample. The range is the difference between the highest and lowest value in the sample and the mean is simply the average sample value.
3. Determine Z from Fig. 1. The sample ranges and difference in means are used to calculate Z from the nomograph. Notice that all data can be multiplied or divided by a constant in order to fit the nomograph.
4. Decide from Fig. 2 whether or not a decision can be reached with the available data. The calculated Z for the appropriate number of pairs of tests (sample size) is related to chance occurrence of Z on this figure. If the plotted value of Z falls above the 0.01, 0.05 or 0.20 confidence lines, we would expect to be wrong in deciding there is a significant difference in samples less than 10 percent of the time. Similar reasoning applies if Z falls above the 0.80 or 0.90 confidence lines respectively, we would expect to be correct at least 80 or 90 percent of the time in stating that the test items were the same. The central

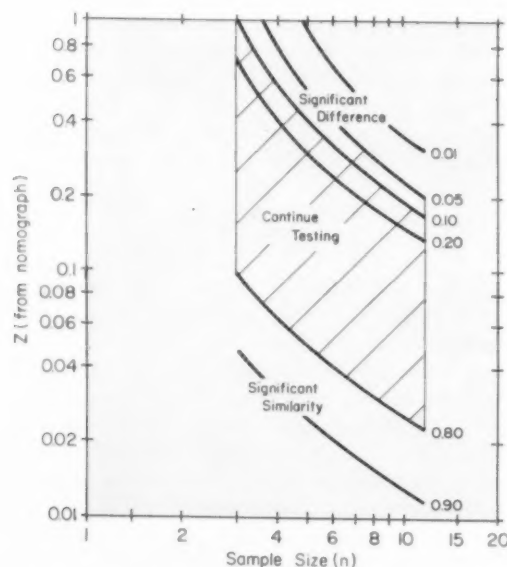


Fig. 2. Test for significance of difference in sample means. Use Z value from nomograph.

area of the curve, depending on the confidence levels selected, indicates that no decision can be reached with the present amount of data.

5. If no decision is reached from step 4, perform another pair of tests to increase the sample size by one and repeat steps 2 to 4. Continue testing until a decision is reached.

EXAMPLES

1. A $\frac{1}{32}$ -inch nose radius was being used on a tool to turn a lot of 100 pieces. Since no problems were encountered by its use, would a $\frac{1}{16}$ -inch nose radius improve tool life? An initial test was made alternating three times the $\frac{1}{32}$ and $\frac{1}{16}$ -inch nose radius tools with the result of 7.8, 7.2, and 7.4 minutes' tool life for the smaller radius tool and 8.6, 7.8 and 8.1 minutes for the larger. The statistical test was applied but did not reveal significance. An additional pair of tests was run giving 7.3 minutes for the $\frac{1}{32}$ -inch radius tool and 8.0 minutes for the $\frac{1}{16}$ -inch radius tool. An analysis revealed that Z was approximately 0.7 which for the sample size of four revealed a significant difference in tools to the 0.10 confidence level. This was sufficient evidence to machine the remainder of the lot with the new tool.

2. A machinability laboratory was requested to select the better of two ceramic cutting tools of equal cost for each of three types of production applications. One application revealed significance to the 0.05 confidence level after seven pairs of tests. A second application revealed significance after five pairs of tests. The last application did not show a significant difference in tools even after the twelve tests. Comparison of the best estimate of the difference in average tool life in the last application indicated that the difference in production cost was negligible. In addition, it was shown that one tool did not have significant greater tool-life variability than the other. It was concluded from these tests that one tool should be specified in the first two applications and either tool could be used in the third.

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RESHARPENING carbide gun drills

GIVEN PROPER CARE, a gun drill will furnish excellent service during its entire usable tip life. On most operations, approximately 75 per cent of the tip length is usable. Resharpener before margin and edge wear become excessive, and careful tool-room handling while grinding assure the maximum number of holes per drilling dollar.

There is no combination of point angles which is superior for all materials. The prime consideration in changing the point angles is to break the chip. Three major characteristics of the point can be altered:

1. The inside angle
2. The outside angle
3. The apex distance.

The beveled point, *Fig. 1*, is an early style which is still used effectively. A beveled point having a 42-deg outside angle and a 20-deg inside angle has

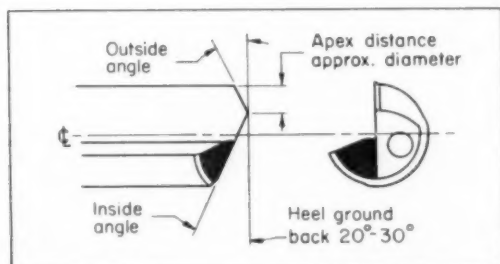


Fig. 1. Beveled point. The apex distance is approximately one-fourth the diameter.

long been used by gun barrel manufacturers, with the drill held stationary. In this case the apex distance is 0.193 to 0.250 times the drill diameter.

Notched Point: To obtain a better oil flow with the same angle combinations, a notch is often ground in beveled points, as shown in *Fig. 2*. Points with small inside angles or with large inside angles are not suitable for the beveled design, for two different reasons. Small inside angles (less than 15 deg) restrict the oil passage from the exit hole in the tip back up the flute, as shown in *Fig. 3*. A notch opens this restriction.

Large inside angles (greater than 25 deg) applied to beveled points can result in a long zone of potential margin wear which reduces tool life and results in loss of hole size and finish. This is illustrated in *Fig. 4*.

Changing the apex angle from the usual value of one-fourth the diameter, will result in a slight loss of

Data courtesy The Cleveland Twist Drill Co., Cleveland, Ohio.

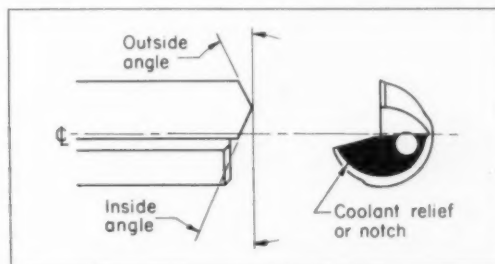


Fig. 2. Notched point gun drill has advantage over beveled point of better coolant flow.

REFERENCE SHEET

size and straightness control. Extreme shortening of the outside angle edge may cause excessive margin wear. Lengthening this edge can cause galling of the wear pad. Point angle combinations which are most effective are shown in TABLE 1.

Point Grinding: Gun drill points do not always have to be completely reground at each sharpening. Often, grinding the outside angle back about 0.005 inch to remove the wear land is all that is required. When complete regrinding is necessary, the following procedure is suggested.

Hand-holding during grinding can contribute to erratic drill performance. A better procedure is to clamp the drill in a rectangular block which can be held securely on the adjustable protractor table of a pedestal grinder. A 220-grit diamond face wheel is preferred. The protractor should be used to obtain the inside and outside angles, and the table tilted to give the clearance angles on the cutting edges. Primary clearance on the outside angle will range between six deg for hard steels

to 15 deg for aluminum and magnesium, Fig. 5. A radial secondary angle of 15 to 25 deg can be put on the outside angle by hand with a little practice. A primary clearance land of $\frac{1}{64}$ inch to $\frac{1}{32}$ -inch width should remain. Clearance on the inside angle ranges from 10 to 15 deg and can be formed with a single straight cut.

Next, the notch is added if a notched point is used. The notch should be perpendicular to the axis of the tool, and should not extend past the center line of the tool, Fig. 6. The notch should be deep enough to allow the cutting corner to lead the heel contact point; if not, interference and drill breakage will result. The depth will vary according to the drill size and point angle used. Suggested notch depths are given in TABLE 2. The values shown in the table can be increased or decreased as the job dictates.

If a beveled point is used the heel is relieved at 20 to 30 deg, as shown in Fig. 7. On both point styles, the final operation is a light chamfer of the sharp edges left by grinding, Fig. 8.

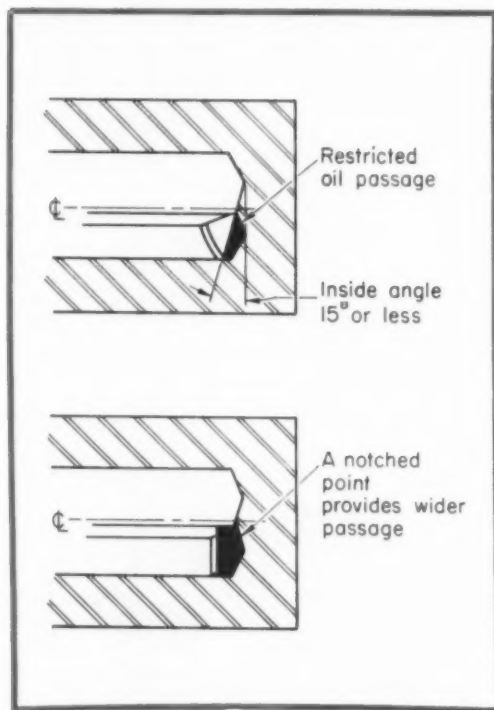


Fig. 3. Comparison of notched point and beveled point with small inside angle.

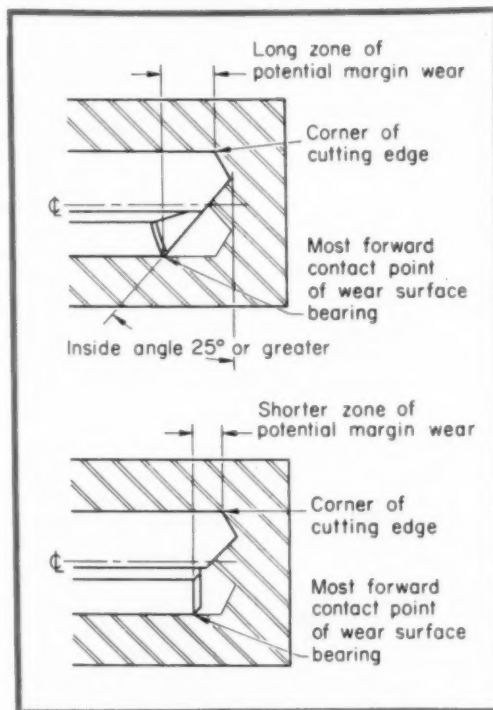


Fig. 4. Comparison of notched point with beveled point with large inside angle.

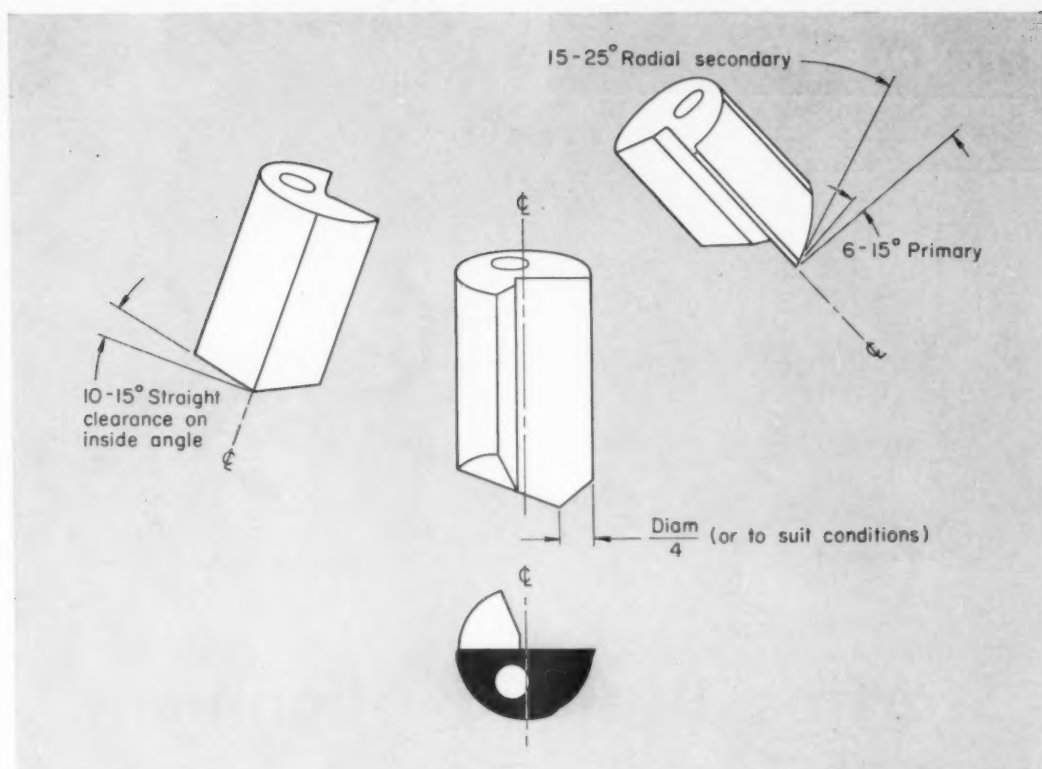


Fig. 5. Grinding clearance angles. Size of angle will vary with material.

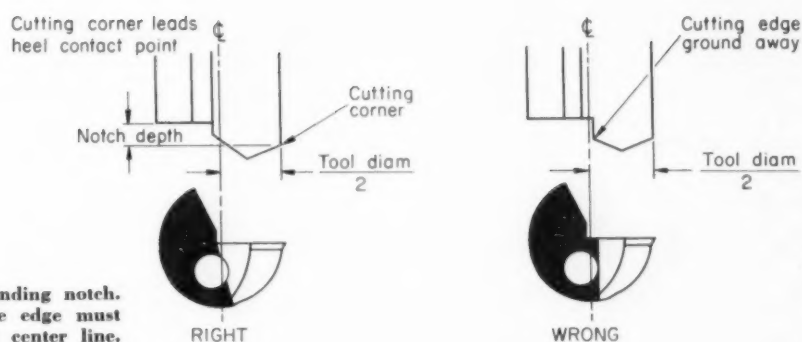


Fig. 6. Grinding notch. Inside angle edge must extend past center line.

Table 1—Point Angle Combinations

Outside Angle (deg)	Inside Angle (deg)
15	35
30	20
10	10
35	15
5	5
20	20
42	20

Table 2—Suggested Notch Depth

Drill Diam (inch)	Notch Depth (inch)
5/32	3/64 to 1/16
1/4	1/16 to 5/64
3/8	5/64 to 3/32
1/2	3/32 to 1/8
5/8	1/8 to 5/32
3/4	5/32 to 3/16
7/8	3/16 to 7/32
1	7/32 to 1/4

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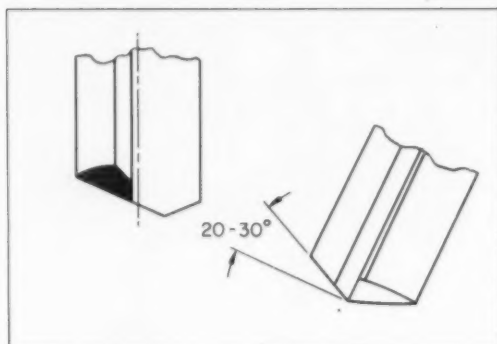


Fig. 7. If a beveled point is used, the heel is relieved twenty to thirty deg as shown.

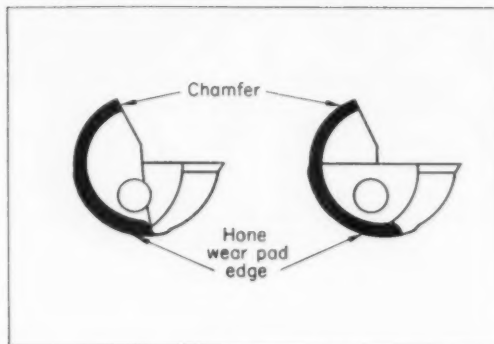


Fig. 8. Light chamfer ($\frac{1}{4}$ to $\frac{1}{2}$ inch by 45 deg) removes the sharp edge left from grinding.

Starting Bushing Alignment

ACCURATE ALIGNMENT between the spinning axis of a rotating gun drill and the starting bushing is essential to good hole production. Misalignment causes drill runout. Severe misalignment can cause drill chipping and may even prevent short, rigid drills from entering the bushing.

Concentricity of 0.0002 inch to 0.0003-inch maximum total indicator reading can be achieved on some precision machines. This may not be possible on all machines; nevertheless, extreme care should be exercised in locating the bushing. The frame, or housing, holding the bushing should be

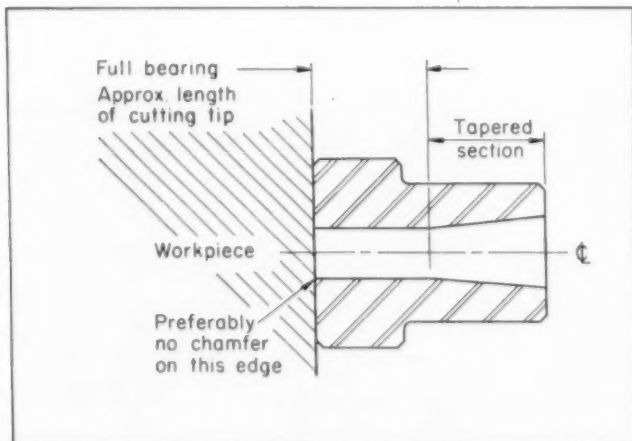
of sturdy construction, since the bushing and its housing must support the drill as it starts its off-center cut.

As a rule, the starting bushing should be replaced when it has worn 0.0006 inch over drill size. Continued use of an oversized bushing will cause loss of hole size and excessive wear on the drill margin. Best practice dictates that the bushing be tight against the work surface, however, in some instances a 0.005 inch to 0.010-inch separation to facilitate loading or indexing has been allowed with no apparent detrimental effects.

The ID bearing section of the bushing should be approximately as long as the carbide tip.

Under some circumstances a shallow counterbored hole may be used instead of a starting bushing. However, this method is rare and is usually confined to large holes in turret lathe drilling.

*Data courtesy
The Cleveland Twist Drill Co.
Cleveland, Ohio*

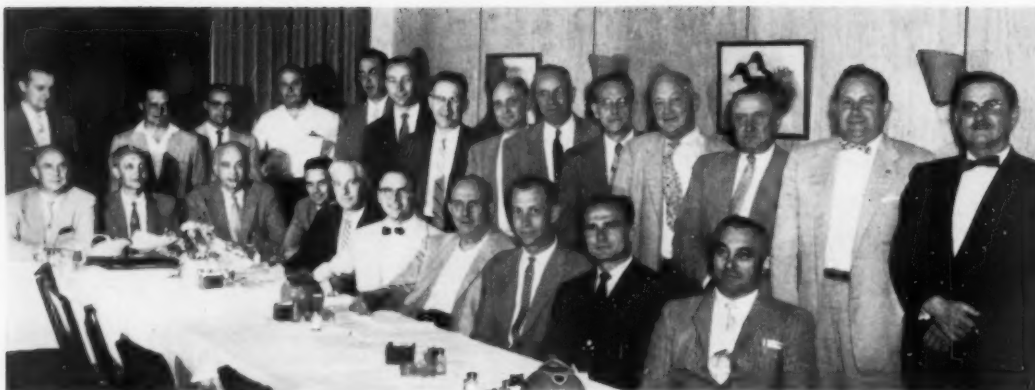


Recommended bushing design. Bushing should be tight against workpiece and held securely.

ASTE

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Two dozen people—an extraordinary turnout for mid-July—showed up for monthly meeting of Milwaukee chapter's executive board. Attendance during other

seasons averages 50 to 60, according to Chairman Joseph Mundbrot (seated, second from left). Seventy-six persons are now serving on the board.

Milwaukee Finds Strength in Numbers

by M. L. Stone
news editor

THE LARGER AND OLDER a chapter becomes, the more susceptible it is to what might be termed organizational arteriosclerosis.

Recognizing this danger of "hardening of the arteries," one of the Society's oldest and largest chapters—Milwaukee No. 4, membership over 500—has set out systematically to pump new blood into its own veins. It is doing a remarkable rejuvenation job, as attested by the uncommonly successful convention which the chapter hosted for its national organization last spring.

Milwaukee not only diagnosed its disease correctly, but it seems to have prescribed the proper therapy. The therapy is activity.

An Axiom Comes to Life

It is axiomatic, of course, that a good member is an active member. Unfortunately, as the chapter well realized, it is also axiomatic that good axioms too often become cliches. The Society's fourth oldest chapter proceeded to rescue the statement from its bromide status; it put the maxim to work by putting its members to work.

Results were readily apparent at the Annual Meeting in April. Never in the 27-year history of the "friendliest" professional Society have delegates and convention visitors found more friendliness, accord-

ing to many old-timers who have been around that long. In addition to the presence of what Milwaukeeans term the spirit of "Gemütlichkeit," there also was evidenced on the part of the host chapter an unprecedented amount of cooperation with National, of efficient planning, and of plain hard work. For example, the chapter expended \$2000 and untold hours to make the Willkommen party the highlight of a standout meeting.

Results of the chapter's renaissance were apparent, too, in the middle of the summer, when even the youngest and most vigorous chapters are apt to languish for a couple of months. This writer dropped in on an off-season executive board meeting, listened in air-conditioned surroundings to three hours of warm discussion, and managed to get away by early the next day.

There were profuse apologies for the size of the crowd—only 25 or so turned out in mid-July for the kind of session that most chapters are happy to have attended by 15 people at the height of their season.

"We expect all of the officers and committee chairmen to attend our Executive Committee meetings, and encourage the committee members to attend too," said Chairman Joseph Mundbrot. "For our winter meetings, it is common to see 50-60 members in attendance."

The chapter, pursuing its theme that a good mem-

ber is an active one, has expanded its executive committee setup to include 109 different posts, filled at the present by some 76 members.

Isn't such a large group too unwieldy to transact chapter business efficiently?

Milwaukee's experience has been that a large executive board, properly chaired, generates more verve and gets more done than a small elite group farther removed from the membership at large. The larger the executive board, in fact, the closer the chapter comes to representational democracy.

No Longer an 'Island'

"Our board is made up of some past chairmen and many newer aggressive members without much committee experience," said the chapter chairman, who himself assumed his first committee assignment only two years ago and was elevated to first vice chairman last year.

"Recently," Mundbrot continued, "the attitude of the Milwaukee chapter has changed a great deal. Suddenly we are interested in the other Wisconsin chapters, the rest of the chapters over the country, the national committees, and in our national officers. In short, Milwaukee is no longer interested in living on their own little island. The credit for this change is due to our well-balanced, aggressive board. I just happen to be the pilot who has the pleasure to work with this fine group. . . ."

Chapter 4 is not unique in its wholesale approach to the executive committee operation. Other chapters are beginning to experiment—notably Windsor, Ont., which is attempting to pull 125 men out of its membership of 385 to work on committees, according to a visitation report by National Director Bruce Fairgrieve.

Reinforcement of the Milwaukee executive board was begun out of necessity to handle the accelerated business of the chapter on the eve of the national convention there. The aggrandizement worked out so smoothly, under immediate Past Chairman Larry A. Wacker, that it has become an integral part of chapter operation in normal times.

Strength in Numbers

It has caught on so firmly that there are now, for instance, eight members serving on the chapter editorial committee alone. Other random examples: eleven are on the membership committee; seven each on the public relations and education committees; six on the professional development committee (which certainly must have been instrumental in raising the percentage of registered tool engineers in Milwaukee from 6 to 9 percent, appreciably higher than the national average).

Members of these committees are not mere num-



Chapter First Vice Chairman Ralph Perlewitz (right) talks over new education committee assignment with a committee member, Joseph C. Kopek. There are seven men on the committee, as many or more on other committees, in line with Milwaukee's policy of putting many members to work.

bers or figureheads, either. The eight men on the editorial committee, for example, have definite standing assignments in addition to special jobs that may arise. Each is assigned to contact the chairmen of three other committees to obtain articles on committee projects, to be considered for publication in the chapter bulletin and for submission to the national magazine. In addition, each member of the editorial group is asked to contact the members of his assigned committees each month, asking for



Second Vice Chairman Keith Entrekin confers with the chairman of his standards committee, James E. Schultz, on a new assignment to gather data on drill-head mounting dimensions. Vice chairmen are encouraged to work closely with the committees under their jurisdiction. Chapter is considering addition of a third vice chairman.

news of individuals' activities and accomplishments.

The executive committee setup itself, whether it be large or small, has been tried and proved over the years. By lifting time-consuming business affairs out of the regular chapter meeting, executive sessions allow more time for technical lectures and educational activities of interest to the general membership. More interesting meetings lead in turn to better attendance.

Training Ground for Officers

Another advantage of the executive committee mode of operation is that the sessions provide an effective training ground for committee chairmen who may one day hold elective officer posts. The larger the executive grouping, the larger the training ground and the better the selection process.

Composition of the executive board is the prerogative of the chapter, but generally includes the officers, committee chairmen, national and alternate delegates, and one or more past chairmen. Sessions are usually open to the chapter membership. The rank and file membership retains other rights too: as provided by the Constitution and Bylaws, the chapter as a whole elects the officers and votes on referendum questions; it also considers such business matters as the executive group deems should have a wider expression of opinion.

Milwaukee is not alone in finding that timing of the executive sessions is important. The board meets monthly, about a week after the regular meeting of

the chapter, so that details of the past program are still fresh in mind for criticism and so that enough time is allowed for thorough planning of the next meeting.

There's nothing unusual about the format for an executive session in Milwaukee, except perhaps the parliamentary decorum and the dignity of the rharbs that occasionally occur. The agenda is much the same as in other chapters: a spoon tapping a glass calls the meeting to order; minutes of the last month's meeting are read after the opening remarks of the chairman and introduction of visitors; then come the treasurer's report; reports by the score or so of committees, either from the chairman or the ranking member in attendance; unfinished business; new business; and adjournment.

Preceding the various committee reports are comments from chapter members holding national office: Larry Wacker, of the National Public Relations Committee, and Paul Wernicke, of the National Membership Committee.

The Milwaukee experiment is worthy of consideration by other sizeable chapters whose leaders may sometimes feel that their organizations are suffering from "organizational arteriosclerosis." Putting more members to work might cure milder chapter afflictions, too, such as anemia or lack of exercise.

The physiological parallel was extended by one of the Milwaukee officers to justify the 76-man executive board.

"A big chapter needs a big heart," he said.



Secretary Gerald C. Woythal reads minutes of last executive board meeting. Indicative of the group's

alertness was the number of questions asked after Woythal sat down.

A SHELF OF BOOKS UNDER ONE COVER

STILL CONSIDERED the most authoritative work in its field after ten years on the market, the *Tool Engineers Handbook* is scheduled to appear at the end of this month in a revised second edition. Conceived in 1943, published in 1949, and now revised in 1959, the handbook remains the top reference work on all phases of planning, control, design, tooling, and operations in the mechanical manufacturing industries.

Realizing, however, that there have been important developments in tool engineering in the past decade, the Society and its National Technical Publications Committee decided to revamp their best seller. And indeed it is a best seller. The demands of those reluctant to wade through a shelfful of reference books when they can reach for a single copy of the *Tool Engineers Handbook* have made it so.

The same skill and cooperation that went into its compilation and made the handbook great ten years ago have made it so again. The new book has been edited to the same high standards as the first one. It will contain 2289 pages including 1709 illustrations and 605 tables. A thorough revision of the early edition's contents in the light of later equipment, techniques and standards has been carried out. And those processes, techniques and equipment not given coverage in the first edition are afforded such now.

The job of revision has been entrusted largely to industrial groups; therefore, data in the second edition is of maximum practical point-of-application use. In all, some 387 authors and reviewers, representing 295 organizations, were recruited for the revising activities.

No significant changes in format or treatment of subject matter will be made, with one exception: while all cutting tools were treated in a separate section in the first edition, the new policy is to describe all tools in juxtaposition with the data on machines and operations related to the various processes. Along with the modernization of data in all sections of the handbook, 23 new subjects have been added. Some sections include data based on new standards formalized since the first edition was published.

The *Tool Engineers Handbook* has probably done more than any other publication to consolidate the thinking of men in this field. It is designed primarily for the engineer who already has a rather thorough knowledge of the tools and techniques of manufacture, but needs the answer to a specific problem of the moment. It presumes the reader comes equipped with basic knowledge of physics, mechanics and mathematics. On this premise, the handbook editors treat none of their subjects to the point of exhaustion. The specialists must still rely upon topical treatises. On the other hand, the book can be useful to the specialist in that it offers him facts concerning other subjects of application, general descriptive matter and information.

Although it is a handbook and not a textbook, the first edition has been used extensively by teachers and students alike. The handbook also offers junior engineers an opportunity to advance more rapidly.

Self-study of the handbook has been undertaken by many manufacturing executives too, who claim that it provides them with a better understanding of the jobs of their employees and a means of measuring their actual performance.

Authors and reviewers from 24 states, selected for their actual in-plant or consulting experience, are represented in the second edition of the *Tool Engineers Handbook*. Their specializations are as widespread as the book's contents. Industrial executives, realizing they will gain by having better-informed engineers in their own and customers' plants, have almost without fail been eager to assign their ablest men to work on the ASTE handbook. The contributions of the men collaborating on the revision project could easily have cost several million dollars at consulting rates, but instead were volunteered "out of the know-how of all for the benefit of all."

More progress has been made in tool engineering and its related fields in the past ten years than in any other span of time. For the *Tool Engineers Handbook* to remain the aid it is to them, it too has to be kept up to date. That's why the second edition—a completely new book, not a rehash—is an indispensable "shelf of books" for members.

Salute to a Decade and a Man



Allan Ray Putnam clearing up some final matters with his friend and boss of ten years, ASTE Executive Secretary Harry E. Conrad.

ONE DAY last month the office of the assistant executive secretary at ASTE Headquarters was vacated. There was not much ado. The conference table, which the occupant had always preferred to a desk, didn't have to be cleared off because it was habitually so. The ash trays didn't have to be emptied, for they were used only by visitors.

An armful of papers; a couple of well-used brief cases; a watch that was the farewell gift of the Society's Board of Directors; the unreserved well-wishes of 70 fellow staff members and of uncounted ASTE members—these were the things that Allan Ray Putnam took with him to his new job in Cleveland as managing director of the American Society for Metals.

Indeed, it is a commentary on the man that he left much more behind than he took with him. For the record, he left a decade of tangible and intangible contributions to ASTE.

Putnam's skill as assistant executive secretary for the ASTE attracted the notice of the 30,000-member metals society, according to Dr. Clarence H. Lorig, ASM president. The choice of Putnam to fill the newly created post of managing director was logical recognition of his behind-the-scenes adroitness in helping guide the ASTE during a dynamic decade.

His departure not only marked a milestone in his career but, in some ways, symbolized the end of one era and the beginning of another for the ASTE. During the years since his coming, ten years ago to the month, the Society grew from its "teens"—in both age and membership—into maturity. Membership rocketed from 17,000 in 1949 to over 40,000 in 1959. The individual tool engineer laid claim to his rightful status as a professional. And the tool engineering profession itself added many new advances—numerical controls, ceramic tooling, explosive forming, plastics tooling, etc.—to an al-

ready lustrous list of contributions to civilization.

"Ray helped us through our growing pains," said Executive Secretary Harry E. Conrad of his assistant. "The Society was fortunate in having him when it needed him the most, during a decade when its dynamic growth most needed direction. The ASTE is in sound shape today, and Ray's role in helping shape us has not been a small one. I'm sure I speak for the officers, directors, members, staff—and certainly for myself—when I express gratitude for a job well done. We will miss him, but we wish him well. We know that he'll do his usual outstanding job in his new position."

Perhaps most typical of Putnam's contributions to the ASTE have been the Leadership Conferences. He has been responsible in large measure for the format planning and the execution of the conferences and for their success in equipping the Society with dynamic leaders at the chapter level. His guidance was not all "from the wings"; his flair for the dramatic and his presence on the stage contributed substantially toward making the 1953 and 1958 Leadership Conferences as successful as they were. The conferences have been assigned an annual place in the Society's operations, and future ones—whether presented on a national or a regional basis—will undoubtedly retain much of Putnam's formula for a "hit show."

Key Role in Closed-Circuit Broadcast

In Putnam's remembrance, an indelible event during his years at ASTE was the far-flung, closed-circuit broadcast which emanated from Houston as part of the Society's 25th anniversary banquet. The program, masterminded by Putnam, was heard simultaneously by 143 ASTE chapters across the nation and Canada. It featured the chartering—by transoceanic radio-telephone connections—of the Society's first off-shore chapter in Sydney, Australia,

as well as talks by some of the foremost leaders in industry, government and education.

Putnam joined the ASTE in 1949 as business manager of THE TOOL ENGINEER, coincident with the Society's taking over active publishing management of its official organ. Besides assuming the duties of assistant executive secretary within two years after he joined the Society, he also became publishing manager of the magazine.

Aside from his record at ASTE, Putnam takes the following background to his new assignment in Cleveland: a degree in economics in 1942 from the Wharton School of Finance and Commerce, University of Pennsylvania; four years in the Army Air Force, attaining the rank of captain; and three years (1946-49) with the American Electroplaters Society. He is immediate past president of the national Council of Engineering Society Secretaries and in 1955 was head of the National Association of Exhibit Managers. Other affiliations include the American Society of Association Executives, the

American Marketing Association, the American Dialect Society, the National Industrial Advertisers Association, and the Engineering Society of Detroit. He has also been a leader in his community.

Putnam left something else behind with the ASTE—a prediction.

"ASTE may be over its growing pains, but it's not over its growth," he said. "It seems to me that the future of ASTE and of tool engineering is limitless. More and more, better and better, for less and less—this is the tool engineer's never-ending role. He is the very core of our whole concept of progress.

"ASTE and its tool engineers face many challenges. The demands of space-age technology; competition from abroad as well as from across the alley; inflation; sociological problems arising from technological advancement—all come within the purview of the tool engineer of the future. This is the Golden Age for men with know-how, and in their vanguard, as always, will be the tool engineer."

Research Paper on Punchability

EXPENSIVE LAPPING or polishing of punches and dies "is not only superfluous, it is even detrimental," according to a paper on punchability that has been translated from the German and published by the ASTE as Research Report No. 22. The translation was made available for Society publication through the courtesy of Armco Steel Corp.

The authors, brothers Otto and Werner Kienzle of the Hannover Technical Institute faculty, in their exhaustive study of "Tool Wear in the Cutting of Thin-Gauge Steel Sheets," contend that it should be possible to reduce the wear by increasing the roughness of the tool face so as to lessen slippage.

The Kienzles' goal was to find a testing procedure with which the life of various tool materials and the punchability of the various workpiece materials (steel sheets up to 0.039-in. thickness) can be compared. With this objective in view, it was first necessary to determine whether the change on the workpiece (the burr) or the change on the tool (the wear) was to be used as a comparison value. The burr is dependent on the amount of die clearance in greater measure than the wear on the tool; therefore, the Kienzles found it is less suitable to serve as an indicator for the properties of material, namely for tool life and punchability.

All the experiments were performed on a punch press running at 600 strokes a minute. Penetration of punch into die was limited. No lubricants were used. Before the beginning of the experiment and

after making a previously determined number of cuts, the condition of the face and side surfaces of the punch, as well as of the face of the die, was examined with a surface scanning device. Each time surface profile pictures were made at same spot.

The economic significance of their investigation is shown, the Kienzles said, by the fact that in Germany alone there are 70,000 punching presses in use. Based on a six-hour day at only 30 strokes per minute, the total punchings per year climbs past the 200-billion mark. If a tool must be sharpened after 60,000 to 75,000 punchings, 3½ million sharpenings on both punch and die are necessary. It is thus economically important to learn the causes of the "obvious differences" existing in the durability of punching tools which are used for punching sheets of different melts, the brothers state.

Of further interest are the authors' observations that punch and die wear decrease with increasing impact speed; that as punchability of a steel improves, its deep-drawing characteristics worsen; and that slippage phenomena help explain why the use of increased hold-down pressure decreases wear.

The report was issued by the Metal Stamping Project Steering Committee of the ASTE Research Fund Committee. Added to the Keinzle paper itself are critical comments from both German and American experts. Bound copies of the report, with appendixes, are available from ASTE Headquarters, 10700 Puritan, Detroit 38, Mich.

St Louis Program Reflects 'Tooling'



Carburetor bodies are drilled, reamed and tapped from various angles at 14 stations of this Kingsbury automatic indexing drilling machine. The machine will be one of those viewed at the Carter Carburetor plant at St. Louis, a division of ACF Industries, Inc.

DIVERSITY has long been the hallmark of St. Louis manufacturing. Industries in the area produce 357 out of a possible 448 classes of products listed by the federal Bureau of the Budget. The 851,000 workers make everything from shoes to street cars, from castings to coffins. Twenty-two manufacturers make toys. One construction company builds banks, only banks.

Besides being the hub of the dry goods trade, the shoe industry, the fur market, the produce market, the drug business—the top producer of stoves and harvest hats and this and that—St. Louis is a transportation center. Rails, airlines, truck lines, barge lines all converge on the city. The metropolis has four airports, 19 miles of riverfront; its inland waterway system is really the largest in the world, consisting of more than 13,494 navigable miles and connecting 29 major industrial centers in 20 states of the Mississippi Valley. . . .

Everybody, as the song indicates, meets in St. Louis, including the American Society of Tool Engineers.

A city bearing such fine industrial qualifications offers a wide choice when it comes to selecting

special manufacturing sites to tour. With the theme of the ASTE's Semiannual Meeting, "Tooling for the 60's," very much in mind, the St. Louis Host Committee has picked three such plants which they think will hold special interest for tool engineers.

On Thursday afternoon, Oct. 8, up to 100 tool engineers will visit the Owens-Illinois Co.'s Alton-Central Shops, completed in 1958 and regarded as one of the country's most modern metalworking facilities. The shop makes repair parts as well as machines for all the company's factories. The major part of the work is for the Glass Container Div.

Friday, Oct. 9, there will be excursions to two St. Louis plants. Emerson Electric Mfg. Co. is on the morning schedule and Carter Carburetor, Div. of ACE Industries, Inc., the afternoon. At Emerson, numerous operations in the manufacture of fractional horsepower motors, including shaft turning and grinding, rotor die casting, end shield machining, press operations, stator winding, and motor assembly, will be on display.

The Carter trip will consist of an examination of the production, inspection and toolroom operations, including die casting of zinc alloy and aluminum. Tool engineers will see a 14-station Kingsbury and Turner indexing machine as well as numerous secondary operations.

These plants were chosen because they epitomize the main concept behind the St. Louis meeting—they are looking and moving ahead into the 60's in their ideas and operations.

Just as the plants were selected for their forward look and their significance to tool engineers, so too were the papers which will be presented at a dozen technical sessions during the three-day Semiannual Meeting. The papers, prepared and presented by experts, will offer the ASTE members attending the sessions a look into what the future promises the tool engineer and what the tool engineer can promise the future.

Reflecting the theme of the meeting—and typical of the interest-arousing sessions that will follow—are the opening day technical programs on "Metal-Cutting Problems" and "New Developments." Of particular interest in the metal-cutting session should be a systematic examination of accelerated lathe tool-life testing techniques to determine their validity under various machining conditions. The experiments were carried out by engineers at Water-

for the 60's' Theme

town Arsenal. Under "New Developments," two papers cover recent progress in electrical discharge machining and explosive forming.

In addition to treatments of problems and techniques basic to tool engineering, there will be special-interest sessions on such subjects as "Electronics Applied to Inspection Problems" and "Safety and the Tool Engineer."

The session on safety is cosponsored by the National Safety Council. One of the papers—"Production Through Safeguarding," by T. A. Kraklow, safety director of Deere & Co., Moline, Ill.—notes that power press operations, despite our advanced know-how, still contribute alarmingly to the accident picture in industrial America. Attachments to presses or dies as an afterthought will not prevent these injuries; rather, Kraklow says, the only way to eliminate them is "to keep the hands from between the dies." Another paper, "Safety and Production—Die Design," by L. A. Faulkner, an industrial safety expert from the Liberty Mutual Insurance Co., agrees that the best way to avoid danger to operators is to eliminate manual, under-the-punch feeding and ejection. Faulkner discusses

adding automation to improve safety conditions.

"Handbooks and How to Use Them" is the subject of another special session. Cosponsored by the National Technical Publications Committee of ASTE and moderated by Willis J. Potthoff, NTPC chairman, the session will present papers by the Society's Technical Director Frank W. Wilson and a McGraw-Hill handbook editor, Richard P. Zeldin.

Many of the treatises have high applicability. An example of good handling of an unspectacular problem is "Hand Straightening of Small Parts," by Raymond L. Jones, associate engineer in IBM's tool engineering department. Manual methods are costly and time-consuming. The author tells how such burdensome techniques may be eliminated by improving and upgrading machine operations or by taking advantage of the commercially available tools that will perform the operation either automatically or semiautomatically.

Other sessions will cover numerical control, grinding, positional tolerancing, heat-treating, building blocks and plastic tools. A total of 24 papers will be presented. All sessions will be held in St. Louis' Chase-Park Plaza Hotels.



Used in punching motor laminations with progressive tungsten carbide dies, these 150-ton Henry & Wright dieing machines will be seen by ASTE visitors to the Emerson Electric Mfg. Co. on Friday of the Semi-

annual Meeting. Founded in St. Louis in 1890, Emerson produces motors, fans, room air conditioners, and special electronic and avionic products for the government. This tour will be limited to 40.

Past President Burnside Dies



D. D. Burnside

DEATH HAS CLAIMED Douglas D. Burnside, a wartime president of the Society and the man most responsible for bringing this magazine under the aegis of ASTE. Burnside, 58, succumbed at his suburban Cleveland home on July 18.

The ASTE's 13th president, who served in 1944-45, died less than a year after the passing of his wife Helen and less than six months after the death of his fellow Clevelander, close friend and immediate successor at the ASTE helm, C. V. ("Clete") Briner.

At the time of death, Burnside was a staff engineer, coordinating design and production, at the Curtiss-Wright Corp.'s Marquette division. He had been instrumental in design and development work on the copilot device for automobiles; this project "had been his whole life" of recent months, according to his college student son, Richard.

A singular devotion to ASTE characterized his life for many years. When he was asked for biographical data on the occasion of his election to a national office in 1942, he stated proudly:

"Not a member of any other technical society."

He was a life member. At death he was second vice chairman of the National Honor Awards Committee, following continuous service as its secretary from the committee's inception in 1954.

Elected to the presidency at the Annual Meeting in Philadelphia in March 1944, Burnside helped post these accomplishments during his tenure:

- Authorization for ASTE Headquarters to move into new integrated offices in downtown Detroit's Penobscot Building
- Decision not to renew contract with the independent publisher of *THE TOOL ENGINEER*
- Increase of membership dues to Senior Member, \$10; Junior Member, \$6
- Contracts negotiated with an editor for *THE TOOL ENGINEER* and with a new books editor for the Society (Frank W. Wilson, now ASTE technical director)
- Deferment of Cleveland Tool Show, scheduled for March 1945, in view of the national war emergency

- Appointment of ASTE Finance Committee
- First issue of *THE TOOL ENGINEER* published by the Society (February 1945); negotiations for paper quota initiated with the War Production Board
- Authorization for investigation of professional engineers' status
- Approval of membership certificate
- Chartering of five senior chapters—Niagara District, Richmond, Flint, Pontiac, and Muncie.

Burnside was characteristically modest in assessing his accomplishments in both ASTE and industry. Of his ASTE service, he wrote in 1947: "It is strange how in retrospect things which were momentous at the time, such as the breakoff with the publishing company, soon become a two or three-sentence reference in a pocket history."

He joined the Society at the second meeting of the St. Louis chapter. Following two years as chapter chairman, he headed the host activities at the St. Louis Annual Meeting in 1942 and was elected that year as national second vice president.

A 1925 mechanical engineering graduate of the University of Maryland, Burnside took his first job with the Clark Equipment Co. of Buchanan, Mich. That year also saw the start of his career in tool engineering, when he developed some "simple" fixtures at the Clark plant to expedite testing and adjusting of truck rear axles. The following years saw his advancement through engineering and supervisory positions with Clark at Battle Creek; American Stove Co. at St. Louis, Cleveland, and Lorain; Consolidated-Vultee; and the Florence Stove Co. at Gardner, Mass. In 1942 he took time out to serve the War Production Board as a \$1 a year industrial consultant.

Other survivors besides his son are two daughters, Mrs. Elizabeth Butler of Fairview Beach, Va., and Susan Burnside of the Cleveland home; two brothers, Harlow of Wilmington, Del., retired from General Motors Corp.; and Merrill of Atherton, Calif., a retired Air Force general; and five grandchildren.

Chips and Chatter



SPRINGFIELD, MASS., chapter made its television debut on WWLP-TV. The story of tool engineering, examples of the engineers' accomplishments, and an analysis of the profound role of the ASTE in the New England economy were presented by (above) Tom Colton of the station, Past National President James R. Weaver, and Chapter Chairman Allen Johnson. Also on the program were Past Chairman Robert Dickson and charter member Fred Wilcox.

QUOTE OF THE MONTH: "Already 450 exhibitors have reserved 94 percent of the available space at the 1960 Detroit Tool Show. And most of them asked for corners."—Leonard Abrams, ASTE Tool Show manager. That many corners the Detroit Artillery Armory doesn't have. But if they mean corners on the market, Abrams says, he has them. Fifteen million dollar show bids fair to draw 35,000 spectators, do thousands in business on the floor, prime the economic pump for millions more.

SANTA CLARA VALLEY chapter now has its library maintained by the Mountain View (Calif.) City Library. A member of Chapter 98 may borrow one of the chapter books from the city library by submitting his ASTE membership card to the librarian. Chapter librarian George McCloud has plans to expand the ASTE group's collection.

Many ASTE chapters devote space in their bulletins to profiles of their members, but perhaps none savor of the informal as much as MILWAUKEE chapter's sketches. Excerpted below are morsels from a Milwaukee profile slated for publication in

the September bulletin. Membership Chairman Dick Bell wrote it, about an "institution" in old Milwaukee named Joe Ebner, past chairman:

"January—around the middle 1920's. Saturday's baking! A big old-fashioned kitchen! Hot crusts of bread with butter laid on like cheese! Top all this with coffee kuchen, washed down with hot milk served steaming in porcelain mugs. . . .

"Joe Ebner is as much a part of nostalgic Milwaukee as was mother's old-fashioned kitchen. 'Unser Choe' with his slow, sly, homespun approach to problems and the boyish twinkle in his eye leads you innocently down the baited path to his foregone conclusion. . . .

"Granted that today's modern kitchens produce good bread with considerable ease. . . . Likewise, today's college-trained engineers and sales people can show you how to do it with ease. So also do men like Joe show you the easy modern methods, having learned their lessons in the college of experience, supplemented by formal technical education crowded into already crammed workdays.

"But Joe has the distinct advantage of *being able to do superlative work the hard way*, with what today's standards must consider simple outmoded tools.

"This work takes effort, but Joe loves to make the effort and is proud in the knowledge of his talents and toil, and the warmth of his helping hand stays with you like the fragrant memory of a frosty Saturday morning in mom's old-fashioned kitchen."

Letters such as the following warmed the hearts of Education Chairman Vic Olsen and others in LONG ISLAND chapter after they awarded prizes to 15 young winners of the second annual design contest.

"Dear Mr. Olsen: My wife and I wish to congratulate your organization on their sincere efforts in encouraging our young sons in a worthwhile field of industry. You, and only you men, can further their knowledge through practical experience. We hope and pray that in the very near future our son will be able to join your society." Signed by the parents of contest winner George Luhrs, Jr.

The contest brought the thrill of creative work experience to 100 student participants.

Members in the News

The California Broach Co. recently announced the appointment of FRANK A. GONZALES, Los Angeles chapter membership chairman, to general manager. Gonzales joined the company in 1952 as office manager and has been sales manager since 1955. He has lectured extensively to technical societies, educational institutions and industrial plants on the subject of broaching, in which he is considered one of the west coast's leading exponents.

ROBERT C. BURGESS of Burgess-Norton Mfg. Co., Fox River Valley member, has been re-elected president for 1959-60 of the American Powder Metallurgy Institute, which is the technology division of the Metal Powder Industries Federation. . . . HARRY M. BETTS, first vice chairman of Houston chapter, who has been directly connected with the cutting tool field for 30 years, has joined Dolan Industrial Sales in Houston. In the late 1940's Betts organized the Standard Screw Products Co., devoted to the production of small parts for industry on single and multiple spindle automatics. He sold the business in 1952 and entered the machine tool sales field. . . . Metal Carbides Corp. has announced the election of R. THORNTON BEEGHLY as president, succeeding his father L. A. Beeghly, who founded the company and has since headed it. The younger Beeghly has been with Metal Carbides since 1934, serving as vice president and general manager since 1936.

ROGER F. WAINDLE, past president (1953-54) of ASTE, announces the purchase of WaiMet Alloys Co. by Howe Sound Co. of New York. Waindle will continue as president of WaiMet and will undertake some complementary staff responsibilities for Howe Sound Co.

RICHARD T. HOWE, Fairfield County chapter, has been appointed assistant plant manager of the Locomotive Div., Avco Corp. Howe, who has been manager of the Missiles Systems Department since

July 1958, has been with Avco since June 1956, when he was named manager of experimental manufacturing for the company's Research and Advanced Development Div. Prior to that he was factory manager for the Delta Corp. and general manager for the Jarvis Co.

HARTLEY W. BARCLAY, past chairman of the Greater New York chapter of ASTE, has joined *Automotive Industries* magazine as editor. Currently a vice president of the New York post of the American Ordnance Association, Barclay served as consulting director for the Henry G. Thompson & Son Co. and the Taft-Peirce Mfg. Co. For more than a decade he was editor of *Mill and Factory* magazine and served for many years as the editorial director of Conover-Mast Corp.

LOUIS D. MARTIN, owner of L. D. Martin and Associates and member of Rochester chapter, is moving his consulting services to California. His address will be 553 E. Walnut St., Pasadena. Martin, who was director of gear engineering for the Eastman Kodak Co. in Rochester for over 30 years prior to the establishment of his own business, is considered an authority on instrument gearing. He is the author of technical articles, some of which have appeared in *THE TOOL ENGINEER*. In addition to the gear consulting service, Martin will be exclusive representative in California for Kurt Orban Co. and a number of other firms. . . . A. E. MATEJKA, registered professional engineer of the Canton chapter, has been named chief product engineer after more than 20 years' association with the Timken Roller Bearing Co. Starting in 1937, Matejka worked on special assignments in the engineering, metallurgical and production divisions of the company, being appointed assistant to the chief tool engineer in 1948. In 1952 he became assistant chief product engineer, a post he held until his recent promotion. . . . JOHN B. BAKER, Canton, who started with the Timken Co. in 1925 as an industrial sales engineer, has been named chief engineer, International Divs. . . . ALBERT ED. PAYNE, president-general manager of the Payne Tool & Engineering Co. and a member of Springfield, Ohio, chapter, has announced a new method of reducing diemaking costs. Payne says that the dies, which are made of the standard metal alloys, replace conventional types and will blank up to a million pieces in mild steel before resharpening or repacing.



R. F. Waindle



H. M. Betts



A. E. Matejka



Donald J. Strittmatter, leader of the Tucson Moonwatch Team, points out satellite-tracking methods to ASTE volunteers in the Moonwatch Modernization Program. Left to right are Strittmatter and members of the chapter's coordination committee, John Rau,

chairman of the ASTE group; Allen Hansen of Industrial Tool and Supply Co.; Bob Oglebay of EPF Tool and Mfg. Co.; Joe Novallo of Western Drawn Products Co.; Mel Bearup of Arizona Tool and Die Co.; and Larry O'Brien of Dental Tool Mfg. Co.

Tool Engineers Rise to Moonwatch Challenge

ONE OF THE ASTE's most civic-minded chapters—Tucson—has volunteered its time and talent to help fabricate piece parts for satellite-tracking equipment.

At the mid-July meeting of Chapter 106, members viewed slides of the activities of the Tucson Moonwatch Team and responded to an appeal for help from Donald J. Strittmatter, leader of the team and president of the Tucson Amateur Astronomers.

Strittmatter told the tool engineers that the Tucson Moonwatch Team was originally formed in late 1956 to track satellites during the International Geophysical Year program. The team was organized in conjunction with the Smithsonian Astrophysical Observatory and the astronomy department of the University of Arizona, with a gift of \$1000 from the Hughes Tucson Management Club.

But while the team has in past years been rated one of the top three teams in the nation, Strittmatter said, it now has become largely obsolete. Present equipment was highly successful in tracking the Russian Sputniks and gathered a mass of productive data for the Smithsonian Observatory, but is too small and underpowered to view the 6-to-30-inch U.S. satellites now in orbit.

When the IGY ended last spring, the Smithsonian reorganized the tracking program into four classifications. The Tucson team, because of its previous superior performance, was chosen as one of 29 among approximately 150 stations across the country to receive a prime "A" rating.

To retain this rating, a modernization program has been started, spearheaded by a \$1000 gift from the Hughes Aircraft Co. in Tucson. This gift and others will buy materials to make ten newly designed deep-penetration tracking telescopes and timing equipment, Strittmatter said.

The moonwatch leader asked for help in this design and fabrication project. From the many ASTE members who offered their tool engineering skill, a moonwatch modernization committee of six was formed, with John Rau as chairman.

The community-oriented Tucson chapter also made the news last year when it volunteered the services of 25 of its members to make a complete cost analysis and study of a revolutionary new lightweight engine. The local Industrial Development Committee utilized ASTE know-how—and saved hundreds of dollars—in its investigation of the feasibility of mass-producing the engine.—*G. H. Moritz.*

chapter news and views

4000 View Displays Of Student Engineers At Utah State Fair

LOGAN, UTAH—The Agathon, an annual educational fair at which each department of Utah State University presents a display to help introduce its program to high school seniors and the general public, was attended this year by about 4000 people. The tool engineering department's display, entitled "Tool Engineering—the Field with a Future," was one of the most popular.

The ASTE student exhibits included an engraving machine which imprinted visitors' names on plastic plates; a Convaire jet part which was used to illustrate the new method of reducing metal to the required size by chemical reaction as contrasted to milling cutters; and a ball-bouncing machine to demonstrate the precision accuracy, hardness and uniformity of manufactured steel balls. In addition, the production-minded students saw displays of the manufacturing processes involved in making evaporated milk cans, the manufacturing analysis of a small gasoline engine, and a model plant layout.

Two films were shown by the student chapter to Agathon visitors. One was "The Space-Age Engineer" donated by the ASTE, and the second, prepared by the student members, introduced the tool engineering department and its curriculum to the high school seniors.



NORTH SHORE—Flight accessory power equipment, and the methods and machinery utilized to produce this equipment, was the subject matter for Chapter 146 when members gathered in GE's Aircraft Accessory Turbine Dept., River Works, Lynn, Mass. Inspecting some of the plant's products are (left to right) Ray Bowen, Ralph Lanciano, Charles Sylvain, Len Sampson, all of GE at Lynn; and Mahon Hutchinson, of Fort Wayne, Ind.

—John C. Knight, Jr.

First Scholarships Given

SAN FERNANDO VALLEY—Chapter 99 handed out the first awards under its recently established scholarship program at its August meeting. Awards as announced by Education Committee Chairman Bob Daly, were \$100 for Bill Darlington of Van Nuys, Calif., High School, and lesser amounts for Stanley Robbins, John Tongish, and Joseph Dunn II, all of Van Nuys; and Donald Olson and Dale Dalton of Reseda High.

Past Chairmen Honored At Long Beach Chapter

LONG BEACH—Chapter 84 paid tribute to its past chairmen at a recent meeting. Irvin Also, chairman, introduced the former chairmen, individually reviewing the contributions of each to the growth of the chapter. Also stressed the assistance they have given to members and to the community, with special emphasis being placed on local scholarship and educational programs.

Raymond Gariss, vice chairman of the National Technical Publications Committee, presented Robert Hillyard and Ed Hendry with special achievement award desk plaques for their contributions to the forthcoming handbook on tooling for aircraft and missile assembly.

The evening's main speaker was Robert E. McKee, who gave an illustrated talk on "Science and Application of Metal Cutting." McKee, director of technical and engineering training at R. K. LeBlond Machine Tool Co., warned that foreign competition will force us to take advantage of and use our latest advances in metal cutting. With proper education and present machinery, there is no limit on cutting speeds, he said. He offered facts and figures on milling and drilling speeds as high as 10,000 surface feet per minute.

—Paul J. Bodnar

What Is a Gadget (gă'jět)?

A gadget is a contrivance, object, or device for doing something; esp., a part of machinery.

When Gadget is capitalized, it means an item in the best-read pages of THE TOOL ENGINEER.

Webster may know how to define a gadget, but a tool engineer knows best how to make one. Have you made one recently?

If you have a gadget that contains a useful idea or an ingenious solution to a tool engineering problem, it may win a prize in the upcoming Gadgets Contest, opening Oct. 1 and closing Dec. 31.

All ASTE members are eligible to enter. Get your entry ready for mailing to the Gadgets Contest Editor, THE TOOL ENGINEER, 10700 Puritan Ave., Detroit 38, Mich.



'Essence of Survival' Is Theme at Cincinnati's 21st Anniversary

CINCINNATI—Included among the 400 members and guests at the Cincinnati chapter's 21st Annual Dinner meeting were 15 past chairmen. They, along with the new chapter officers, were individually introduced to the audience.

The anniversary meeting prompted well-wishes from the Society's national governing body. Vice President H. Dale Long delivered the congratulations. He was followed by the main speaker of the evening, Louis Polk, president of The Sheffield Corp. and vice president at Bendix Aviation Corp.

The control of quality to assure 100 percent product reliability is the "essence of survival" in a competitive market, Polk said. The "go power" necessary to improve product quality and reliability is contained in that compulsion possessed by today's manufacturers to meet high-product standards being set by competition. This compulsion benefits everyone, consumer and producer alike, because its ultimate end is a better quality product at lower manufacturing costs, he stated.

Missiles, extended-flight aircraft and satellites are making household words of "quality" and "reliability." In a period as short as two years, Polk continued, these words have moved out of the shop and onto the front pages of the nation's newspapers. As a result

Americans are being subconsciously educated to compare the performances of their cars, TV's, washers and similar items to those of missiles. Letters of complaint to manufacturers of these products contain words and phrases like malfunction, burn-out, blooper, and poor programming, terms once considered the exclusive jargon of military men and industrialists.

Because people are becoming quality conscious and placing greater emphasis on reliability, Polk said, quality control teams in a great many plants are getting the benefit of top level thinking and action. Management is becoming aware of the fact that the men in charge of building and inspecting a product cannot "fully perform their true function unless there is an appropriate awareness and active acceptance on management's part of the goals of quality control."

Calling the tool engineer the key man in industrial development, therefore directly connected with quality and reliability of a product, Polk praised the Cincinnati tool engineers and their counterparts throughout the nation for their ability to "fuse men, machines, and materials into a smoothly working team, dedicated to producing more and better goods and materials at fair prices to all.

—Clarence Keller



Russell W. Lamb (left), second vice chairman of Chapter 27 and active member of Toastmasters Club No. 1377, watches as ASTE President Wayne Ewing and John W. Haynes, past president of Toastmasters International, discuss plans for Haynes' lecture tour. He will meet and talk with the chairmen of the 13 ASTE chapters in California to impress upon them the importance to tool engineers of being able to communicate orally and convey their ideas to other people.

Peoria

One hundred five were present at the May 5 annual ladies night where Dean McNaughton, editor of the Pekin Daily Times, spoke on "A Tour of Russia." He showed color slides which were taken in Russia during his visit there in 1958 with 30 other businessmen.

During the month of April, the Peoria chapter participated in two student Science Fairs, held at Bradley University and Pekin, Ill., High School. Arrangements for the displays were supervised by Kenneth Bledsoe, chairman of the Education Committee.



GREATER HARRISBURG—Thomas E. Hayes of the metallurgical products department of General Electric Co. was guest speaker at the three-day seminar on "Tool Cutting Edges" in Hershey, Pa. The seminar was sponsored by ASTE Chapter 149.

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SAN FERNANDO VALLEY—Chapter Chairman Tommy Tomlinson poses a question on patent law to Patent Attorney William D. Sellers (center). Chapter members had heard Sellers' talk on "Inventors and Inventions in Industry" at July meeting. Program Chairman Ralph Marsden listens at left.

—John R. Bethune



RACINE—Chairman Byron Peterson presents Chapter 2's \$200 scholarship to William S. Adams, who will use it to help finance his junior year in mechanical engineering at the University of Wisconsin. Two other U. of W. students, Daniel Eber and Ralph Ludwig, received scholarships of \$300 and \$150 respectively.



SAN FERNANDO VALLEY—Ralph Marsden, program chairman of Chapter 99, extends the group's thanks to Robert E. McKee, director of technical and engineering training at R. K. LeBlond Machine Tool Co., who spoke on the science and application of metal cutting at the May meeting.



SANTA MONICA BAY AREA—Chapter 153's new officers are (left to right) J. J. Apalategue, second vice chairman; Albert Schub, treasurer; Harry Cornwall, chairman; Harold Hanmer, first vice chairman; and J. R. Franks, third vice chairman.

—Charles V. Livesey

Greater New York Adds Managerial Courses to Program

GREATER NEW YORK—Engineering societies across the country have with each passing year been reporting an increasing number of engineers entering the management field. In keeping with this trend, the Management Institute of New York University in association with ASTE Chapter 34 has slanted its program of courses more toward the tool engineer who is looking for a more active role in management. Previously, courses have been strictly technical.

An additional change, as reported by Chapter Education Chairman Louis Wertman, is the offering of a certificate upon completion of a prescribed number of courses. Classes will begin the week of Sept. 21, with registration during the preceding two weeks. Among courses to be offered are Simplifying Manufacturing Methods and Techniques; Controlling Manufacturing Costs; Cost Estimating; Statistical Quality Control; New Product Creation and Development; and others on automatic production and plant planning and layout.

Also planned jointly by the university and the chapter is a Manufacturing Engineering Clinic, which will consist of 15 problem-solving sessions, starting Friday, Sept. 25, and conducted by Wertman. This will be the second year for the clinic. One of the important accomplishments last year was the development of a tool for estimating the handling time on prototype and small-lot manufacturing. This tool is now being tested by the companies that assisted in its development, and results of the study will be made public upon completion.

The entire company and not any one individual is "enrolled" in the clinic. Different persons can be sent to each session. Purpose of the clinic is to assist the member companies in the solution of problems within their plants and to inform them of the experiences of other persons in all areas of manufacturing engineering.

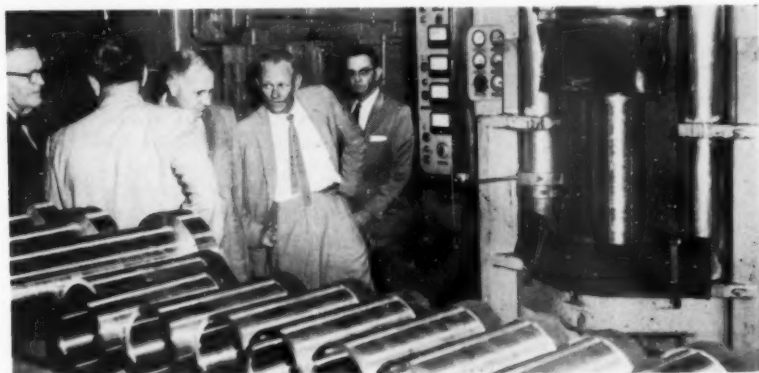
Greater Lancaster

In Chapter 89's first regular meeting of 1959-60, members will tour the Lancaster, Pa., facilities of the Slaymaker Lock Co. They will view the varied operations in the manufacture of padlocks, including foundry work, investment casting, buffing and polishing, plating, and progressive dies for stamping, coining and forming. Works Manager Joseph E. LePage will be their host on the tour, which is scheduled Sept. 8.

—Richard J. Kintzi



Presenting a *Tool Engineers Handbook* to Peter Jaroszkiewicz (right) for his outstanding scholarship at Alliance Technical Institute is Erie Chairman Richard Banaszek (left). John Mazzuca, also an award winner from that school, looks on.



HOUSTON—Members watch the honing of mud pump liners during plant tour of Mission Manufacturing Co., makers of oil well drilling equipment. Left to right are W. R. Montgomery, plant guide Otis Tyle, Chapter Treasurer R. M. Hoffman, Dick O'Leary, and First Vice Chairman Harry M. Betts.

—Lee Dolan



MILWAUKEE—John A. Gasiorowski, education chairman, looks on as Chairman Joseph Mundbrot presents engineering scholarships of \$400 each to two outstanding high school students from the Milwaukee area, James A. Stiles, Boys Technical High School, and Richard G. Joecks, Custer High School.

—Roger D. Cox

Four Technical Students Accept Erie Awards

ERIE—Just as it has done in past years, Chapter 62 presented four students with awards for their scholastic achievement in subjects related to tool engineering. The students, George D. Hall and John Patalon of Behrend Center, Penn State Extension, Erie, Pa., and Peter Jaroszkiewicz and John Mazzuca, from Alliance Technical Institute, Cambridge Springs, Pa., were given *Tool Engineers Handbooks* and student membership in ASTE.

Dean E. J. Kruszka of Alliance Tech addressed the group briefly. He stated that his choice of outstanding students was not based solely on scholastic averages, but also on their unusual aptitude toward extra work. He felt that too much emphasis is often placed on averages alone and other characteristics of a student are overlooked.

The technical speaker at this same meeting was C. R. Stroupe, vice president of Anocut Engineering Co., Chicago. Stroupe, in his talk on electrolytic grinding, pointed out that this technique is used primarily for grinding carbide and other tool steel. A great advantage it claims over other types of grinding lies in the small amount of heat involved. Because of this, no metallurgical damage is done to the piece being ground.

—Andrew Plaza

Long Beach Tours Alcoa's Vernon Plant

LONG BEACH—The extruding process, in which aluminum tubing can be reduced to one-quarter size, held the interest of about 100 chapter members and their guests during a mid-July tour of Alcoa's \$32 million Vernon Works.

The Vernon plant, one of southern California's newest, is unusual in the aluminum industry in that it does not specialize in any one aluminum product.

In the rivet department, the visitors were especially interested in barrel burnishing, a topic covered at one of the recent monthly meetings. The 3½-hour tour was organized by Ben Beveridge, the program committee chairman.

—Paul J. Bodnar

Faculty Adviser Dies

BOSTON—Dean Ralph G. Adams of Franklin Technical Institute died in Freeport, Me., recently at the age of 69. Adams was faculty adviser for the ASTE student chapter at Franklin and was a member of Boston chapter. A 1911 graduate of M.I.T., he was also professor of mechanical engineering at the Lowell Technological Institute.



GRANITE STATE—Chapter members recently toured the Arwood Corp. plant in Tilton, N. H., manufacturers of castings by the investment and lost wax process. Shown here during tour of plant are (left to right) Bruce Ambrose, Charles Childs, Chief Process Engineer Kenneth L. Herrick of the plant, Chapter Chairman Robert Ellison, and Program Chairman Ray Cunningham.
—Judson H. Downing



UTAH STATE—Officers of Student Chapter 2 for the coming year are (left to right) Don Freeman, treasurer; Jack Burr, secretary; Lew Cantwell, chairman; Rex Williams and Blair Muhlestein, vice chairmen.



PURDUE—The newly elected officers of Student Chapters 6 view a demonstration of explosive forming by Mel Miller (center), outgoing chairman. Watching are (left to right) O. D. Lascoe, faculty adviser; R. T. Sheets, second vice chairman; L. D. Spangler, first vice chairman; Miller; Louis M. Brubaker, secretary; Robert A. Earle, treasurer; and Richard Leshuk, chairman.

Barrel Finishing Discussed at Ithaca

ITHACA—"What Can You Do with Barrel Finishing?" This question was raised and answered by Chapter 157's guest speaker at the monthly meeting. William Biebel, vice president of Esbee Barrel Finishing Corp., Byram, Conn., demonstrated his theory with the aid of raw eggs, rather than machine parts.

While there are at least six types of barrels used in barrel finishing, the most versatile of all is the closed horizontal type made of welded sheet steel. Things to be taken into consideration when barrel finishing, Biebel said, are the size of the part, the medium to be used, the selection of the compound, and finally, the water level.

The effect of water level plays an important part and can be used to good advantage. Increasing or decreasing the cutting action of the medium is done simply by lowering or raising the water level. If the action of a large medium is too harsh, it can be tempered simply by raising the water level. Water level is also important in wedging and separating parts, acting as a buoyant, the speaker added.

Some experimentation is recommended for maximum efficiency, Biebel stated. Almost every type of metal can be barrel finished, including tiny metal jewelry parts. Removal of burrs, breaking edges, and forming radius can be done to specifications with greater uniformity and fewer rejects.

Biebel said the operator in barrel finishing must have interest and pride in results and theory of the technique. Careful study is necessary in order to avoid costly mistakes. —Anna B. Gage

Awards and Installation Highlight Student Meeting

CALIFORNIA POLYTECH — Student Chapter 12's fourth set of officers, installed by National Director Ben Berlien, are James Barth, chairman; Emil Saxberg, first vice chairman; Ferdinand Basler, second vice chairman; James Ryan, treasurer; and Buell Brown, secretary.

California State Polytech's sponsoring chapter, Los Angeles, presented its President's Award to Francis Whiting for his work as faculty adviser to Chapter 12. Donald Gunn received a \$250 scholarship. This is an annual award given to a senior student at Poly whose major interest is tool engineering. An award of merit went to Dean Knott of the engineering school for his support and service to Chapter 12.

—Buell L. Brown Jr.



DAYTON—Chairman Andrew Bailey greets Dr. Neal Bowman of the National Association of Manufacturers, who addressed a special meeting honoring past chapter chairmen and executives of Dayton manufacturing concerns. Bowman challenged Americans to realize their shortcomings; recognize the need for positive action to the economic challenge of communism; and revitalize their confidence in "The American Way of Life."
—Ralph E. Frederick

Plastics Expert Discusses Trends

LONG ISLAND—Plastics is one field, at least, in which the United States is definitely ahead of Europe. This report came from the president and general manager of the Furane Plastics Co. of Los Angeles, John Del Monte, who talked to tool engineers of Long Island chapter only hours after he had returned from a survey of plastics developments on the Continent.

"There's nothing to learn from Europeans," Del Monte said at the May 11 meeting. "The reason for this is probably that the chemists—rather than the engineers, as in the United States—have the job of application. In this country, plastics are considered more and more to be an engineering material."

Most of the ideas that generate new trends and developments in plastics tooling are coming not from the plastics people themselves, Del Monte said, but from tool engineers. "We welcome anything from you metal people that will help achieve optimum efficiency in materials. You engineers call for the material you want; then our chemists will develop it."

In noting other trends, Del Monte cited the ASTE-sponsored research and shrinkage tests on plastics at Purdue University as encouraging standardization. He also pointed out that color is being used more and more in functional plastics. His firm is one of the leaders in formulating epoxy resins for plastics tooling, adhesives, electrical insulation and corrosion resistant coatings.

SPECIAL EVENTS

ASTE Semiannual Meeting	Oct. 8-10, 1959
ASTE 28th Annual Meeting	April 21-28, 1960
ASTE Tool Show	April 21-28, 1960

The Chase-Park Plaza Hotels, St. Louis, Mo.
Statler-Hilton and Sheraton Cadillac Hotels, Detroit.
Detroit Artillery Armory.

Conferences Slated On Three Campuses

Three on-campus conferences have been scheduled for this month, and at least three more are tentatively planned for November.

Oct. 17 is the date set for a session at Long Beach City College. A week later, Oct. 23-24, the second annual conference at McMaster University in London, Ont., will be staged by the Canadian Council of Chapters. The Illinois Council of Chapters will hold its eighth annual on-campus conference at Joliet Junior College Oct. 30-31.

Conferences planned for November include North Carolina State College, Mohawk Valley Technical Institute, and the University of Arizona.

St. Louis

At a recent meeting members learned that practically all design problems can be classified into one of 12 different types and the first step in solving them is to recognize the type of problem. Stanley R. Cope was the speaker whose talk was based on his many years of experience as a consultant to metal stamping industry.

Paterson Chapter Classifies Carbides

PATERSON—A forum on carbides was held at the April meeting of Chapter 102 with 80 members and guests participating. The discussion, given the official title of "Chart Classification of Carbides," was carried on by four main speakers: John Shoplock, A. N. Nelson, Inc.; Henry Konopka, Wesson Co.; V. G. Yost, Firth Sterling Co.; and A. J. Fisher, Adamas Carbide Corp.

Questions were directed at these panelists from the floor, thus enabling each member to clear up any doubts he might have had concerning the applications and advantages of carbides. Before the conclusion of the panel discussion and after all questions had been answered, the four speakers agreed that the manufacturing of carbides as handled by individual companies is more or less an art. Even though carbides may fall into chart classifications, they differ slightly from one manufacturer to another.

—N. Cofrancesco

Positions Wanted

MECHANICAL DESIGN SPECIALIST

—Twenty-four years' experience, including shop work, tool and machine design, instructor and supervisor of tool and machine design in private technical school, quality control, supervision, specialization in cam design and computation. Senior member ASTE since 1942. Resume upon request. Inquiries will be answered. Available immediately. Address replies to: Classified Ads, Dept. 155, 10700 Puritan Ave., Detroit 38, Mich.

MANUFACTURER'S REPRESENTATIVE

—Established manufacturer's agent and registered P.E. seeks additional line in the tool and machine field. Current product in the machine tool accessory field. Area of representation—Metropolitan Detroit. Write to: Classified Ads, Dept. 158, 10700 Puritan Ave., Detroit 38, Mich.

Positions Available

DIE DESIGNER and a **DIE FOREMAN** experienced in jobbing shop procedures. Write to: Classified Ads, Dept. 163, 10700 Puritan Ave., Detroit 38, Mich.

MACHINE TOOL SALES ENGINEER

—for liaison duties with dealers. An excellent opportunity for an experienced machine tool sales engineer. Must have shop background in addition to sales experience in basic machine tools including cylindrical grinders and jig borers.

Position involves extensive traveling from company office in N. Y. area. Replies (in confidence) should include personal data, education, experience, and salary record. Write to: Classified Ads, Dept. 157, 10700 Puritan Ave., Detroit 38, Mich.

MECHANICAL ENGINEER (Tool engineer) with research experience for supervising research in the punching of sheet steels. Salary commensurate with training and experience. Large research laboratory, Pittsburgh area. Forward complete resume and salary requirements to Classified Ads, Dept. 159, 10700 Puritan Ave., Detroit 38, Mich.

ASSISTANT EDITOR—Must have practical experience in the tool engineering field, plus proven ability to write and edit engineering articles for publication. Degree in engineering or science desirable. Travel required. Salary open. Send resume to: John W. Greve, Editor, THE TOOL ENGINEER, 10700 Puritan Ave., Detroit 38, Mich.

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Cut-off Machine

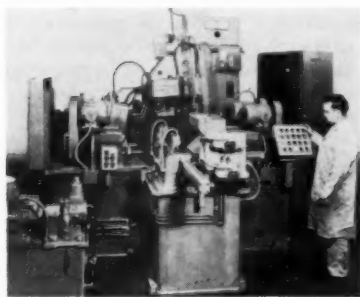
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508 Harrison St. Kalamazoo, Michigan

Progress in Production

TRANSFER MACHINE DRILLS AND PROBES

Fully automated, a six-station special in-line transfer machine drills and probes holes in truck engine rocker arm shafts at a rate of 211 parts per hour at 100 percent efficiency.

The rocker arm shafts are fed to a transfer way from a hopper feed and escapement mechanism at one end of the machine. A rotating finger transfer bar actuated by a hydraulic cylinder at the end of the transfer way advances the SAE 1010 tubular 17-in. long, $\frac{3}{4}$ -in. OD rocker arm shafts from station to station for the various drilling and probing operations. Individual parts are lifted a small amount by spring-loaded centering fingers that enter each end during the transfer operations between stations. Clamping fixtures at each station locate the parts for the machining and checking operations. One of the holes produced in the first drilling station is utilized as a radial locating hole for succeeding drilling, idle and probing operations.



Snyder fully automated in-line transfer machine drills and probes truck engine rocker arm shafts at a rate of 211 parts per hour.

Parts in a hopper are placed on the transfer way at station one. Station two has a pair of opposed drilling units

that drill one 11/32-in. and three 13/32-in. holes. Station three is idle but has a clamping fixture and hole locator to prevent part rotation. At station four there is one horizontal drill head and one vertical drill head. Each head drills six $\frac{1}{8}$ -in. holes. Station five is an idle station with a clamping fixture and hole locator. At station six the two sets of six $\frac{1}{8}$ -in. drilled holes are probed to check for broken drills or incomplete holes. The machine shuts down automatically if the probes indicate an incorrect drilling condition.

One of the 13/32-in. holes drilled in the second station is utilized as a radial locating hole at all successive stations. A tapered pin is advanced into the hole by a hydraulic cylinder after a light clamping at each station. Final clamping pressure is applied after the tapered pin has positioned the part in proper radial location.

The Snyder machine occupies a floor space approximately sixteen feet long by nine feet wide.

ULTRASONIC GAGE SPEEDS PRODUCTION

Nose cones for the Nike-Hercules missile are inspected by means of an ultrasonic resonance gage. Shaped on hydroforming and hydrospinning machinery at the Lycoming Div. of Avco Corp., the cones must be extremely accurate in contour and size. Wall thickness, for example, must be held to within ± 0.006 in.

Measuring inside the narrow neck would be extremely difficult with deep-throated calipers or other devices, and results would not be obtained as surely and quickly. The ultrasonic gage provides thickness readings instantaneously, and to extremely close tolerances.

When the transducer is placed against the outside surface of the cone, high-frequency mechanical vibrations are transmitted into the metal. Fed back into an electronic circuit, resonant vi-

brations are shown by two or more vertical traces on the face of the cathode-ray tube. A scale placed in front of it indicates wall thickness directly.



An Avco Lycoming operator inspects Nike-Hercules missile nose cones with a Branson Vidigage ultrasonic resonance device.

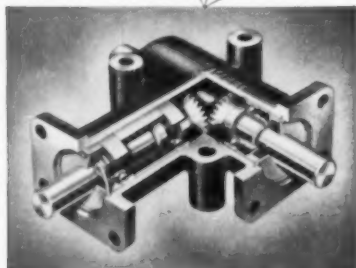
The nose cone is cut from 6061 aluminum sheet stock, preformed in a hydroform press, then spun into its final shape in three stages. Completed nose cones are checked for roundness and wall thickness. Minor thickness variations are quickly detected.

GAGE CHECKS THICKNESS, DRAWS PROFILE OF SHEET STOCK

An inspection problem common to manufacturers and users of sheet stock, i.e., steel, aluminum, plastic, missile skins, and precision stampings, is statistical examination of the thickness of a piece of sheet to detect high and low spots, to obtain size data from which to prepare a thickness profile, or to provide a thickness calibration certificate.

Because the present method of using a mechanical gage is a tedious, time-consuming task dependent upon human skill, The Sheffield Corp., a subsidiary of Bendix Aviation Corp., developed a pneumatic gage recorder for laboratory and production inspection that charts

**NEW 2¼ HP
ANGLgear®
HELPS SIMPLIFY
YOUR 90° DRIVE
PROBLEMS**



Hardened bevel gears and antifriction bearings insure smooth, trouble-free operation. Completely enclosed, permanently lubricated ANGLgear requires little or no maintenance.

Addition of the new 2¼ hp size to the ANGLgear line makes it easier than ever to solve your 90° power takeoff problems with this standardized right-angle drive. You can now specify ANGLgear in any one of 16 different stock models, offering power ratings from ¾ to 5 hp, with choice of 1:1 or 2:1 gearing and 2 or 3-way shafting.

Compact, high capacity ANGLgear offers you several distinct advantages over V-belts or chains and sprockets. Featuring 5-way mounting, it is easier to design into your power transmission systems. Incorporating positive bevel gear drive, it eliminates slippage and backlash problems. Completely enclosed, it presents no safety hazards. Permanently lubricated, it requires virtually no maintenance. And not the least important, ANGLgear invariably costs less than other types of 90° drives.

See our literature in Sweet's Product Design File or contact your local distributor.



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thickness deviation simultaneously with gaging.

Gaging the thickness of a five-foot long sheet every one-half inch along the theoretical centerline would require 120 gage adjustments, readings and listings with present mechanical gages.

With the pneumatic gage recorder, there are no gage adjustments, no hand-written figures. The operator simply moves the size-sensing element along the sheet, or the sheet can be moved through the gage head, and size deviation is automatically charted on a 4-in. wide strip chart. Chart travel is either intermittent or continuous, being operator selected at the flick of a switch. With index drive, approximately ½-in. length of chart is required for each gage reading. Standard chart speeds are 1, 2 or 6 ipm or 9 in. per hour. Other chart speeds are available on special order.



Using a pneumatic gage recorder to simultaneously air gage and record the thickness of sheet stock at preselected gage points.

Both contact and noncontact air gage tooling can be used with the pneumatic gage recorder which offers a full scale tolerance range from ± 0.0003 to ± 0.040 with proper tooling. Because the instrument accommodates interchangeable tooling, internal as well as external dimensions can be inspected. A two-dimension unit with two scribing pens is also available.

The combination air gage recorder can also be used with spindles for checking bores and with fixtures for charting various dimensions.

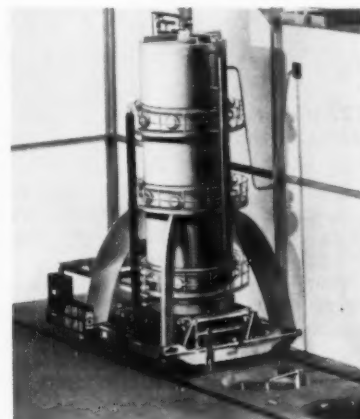
FURNACE WILL PROCESS ROCKET, MISSILE PARTS

Gigantic parts for rockets and missiles will be heat-treated in a gigantic furnace at Commercial Steel Co. The new furnace is of vertical, drop-bottom design and stands over forty-two feet above floor level on a specially designed gantry type, mobile car.

It is of the gas fired, radiant tube, controlled atmosphere type, capable of clean-hardening or gas carburizing a

missile motor case or general industrial parts, 70 in. in diam. and 28 feet long, weighing up to four tons. A full 74 in. diam work area can be achieved by readjusting the radiant tube placement within the chamber.

Operating temperature of the furnace will be 1850 F with provision for higher temperatures if desired. A large-capacity recirculating fan located in the movable bottom cover assures both uniform temperature and even atmosphere gas distribution throughout the furnace.



Drop-bottom heat-treating furnace will process 28-ft missile motor cases, accurately heat-treating them in one piece. Furnace was made by Holcroft.

The furnace travels under its own power to quench its load into oil, water or nitrogen gas quenching pits constructed over forty feet below floor level. Transfer to quench is accomplished without atmosphere contamination by means of an inert gas shielding curtain especially developed for this installation.

Vertical construction of the furnace permits highly accurate processing of parts with a minimum of distortion and scaling as well as a much faster, easier handling from furnace to quench.

BAND MILL CUTS POWDER-METAL BILLET

Slicing 13 Beryllium reactor plates from one gigantic billet instead of producing them singly kept deliveries on schedule, saved 200 hours of valuable furnace time, and saved over \$50,000 worth of material. This out-sized job was performed by Brush Beryllium Co.

The parts required were 13 hexagonal plates, 30 inches high and in thicknesses from 1 to 2 inches. The plates are hot pressed from high-purity beryllium to produce dense, homogeneous billets with good mechanical properties. If

pressed individually, each would require a thickness allowance to remove the slightly dished shape resulting from the pressing. Instead, one 2575-lb billet, 36 inches in diameter and 36 inches long, was pressed. The saving at this point was 200 hours of furnace time.



Nuclear reactor components will be sliced by a DoAll band mill machine from this billet of beryllium. After cutting the billet into three sections, deep holes are trepanned and the sections returned to the mill to be sliced into thin plates.

To cut the huge billet down to size, a DoAll band mill was used. After machining the cylinder into a hexagon, it was divided into three parts for trepanning the holes. The trepanned pieces were then returned to the band mill and sliced into the required 13 plates.

For this operation a 2 inch wide, 2 pitch, high-speed steel saw band was used at 130 to 140 fpm with coolant. The time per cut averaged 12 hours. If the plates had been pressed singly, additional material would have been used and additional machining allowance would be necessary for each plate.

SULFURIZED OIL IMPROVES HOB LIFE

By introducing a sulfurized-mineral cutting oil (Gulfcut 21C) on a new Barber-Colman No. 12 gear hobber, a manufacturer of rock drills obtained a 100 percent increase in production over an older machine on which a soluble oil was used.

Le Roi Div., a subsidiary of Westinghouse Air Brake Co., made the cutting oil switch at its plant in efforts to increase feeds and speeds on the gear hobber. The machine is used to cut flutes on rifle bars for Le Roi drills.

With the soluble oil used previously only seven finished splined shafts were obtained from each hob shift before dulled teeth forced a change to the

next shift. Each hob, made of M2 material, has five rows of cutting teeth.

With the sulfurized-mineral cutting oil, 21 finished pieces were made before the shaft became so dull that it had to be changed.

According to Gulf Oil Corp., the cutting oil controls the build-up edge by effective antiweld compounds, resulting in increased production by permitting higher feeds and speeds.

After analysing the implications of the increase in production, it was decided to pull back from this direct gain in order to get a more economical balance between hob life and production rate.

By reducing the depth of grind, hobs are made to last twice as long and, at the same time, twice as many rifle bars per hob are produced. With hobs at \$100 each, significant savings are realized by this practice.

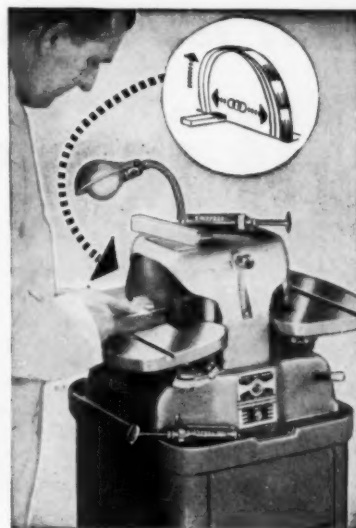
Acting on this experience, the rock drill plant now uses the sulfurized-mineral cutting oil in a second gear hobber, in horizontal and vertical broaches, and in a threader.

With the better heat-dissipating ability of the oil, and its unusual antiweld properties, critical dimensions are held within tolerances. Its cooling properties check the tendency of both tool and workpiece to expand under the heat generated by their interaction. If not cooled effectively, the tool will overcut and destroy tolerances.



Production of these splined rifle bars was doubled, with hobs lasting twice as long between grinds, when a sulfurized-mineral cutting oil was used with the new machine. The sulfur activity in the cutting fluid controls built-up edge. Increased wetting and cooling action of the oil also gives a better finish on rifle bars.

By holding within tolerances consistently and by keeping hob cutting edges sharper over longer periods, the active sulfur compounds in Gulfcut 21C are effecting a greater cut down of jagged microscopic peaks (asperities) on the surface of the steel workpiece to provide better finish.



Step-up feeds, speeds, production... finish your cutting tools with **HYPREZ OSCILLATING LAPPING MACHINE**

Records prove that the Hyprez Lapping technique increases tool output per grind 200% to 700% — improves speeds and feeds 50% to 400%. The lapping wheels rotate as they oscillate across the firmly held tool—producing a geometrically accurate and scratch-free finish.

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Hydraulic checking of the movement of an air cylinder piston rod smooths out the natural "bounce" or "springiness" of air—gives to air power perfect smoothness, complete freedom from chattering.

Hydraulic checking of air cylinder power has become standard in practically any pneumatic operation involving precision control.

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- ELECTROAIRE** — the electrically controlled four-way valve for integral mounting on the Bellows Air Motor or for remote control of any air cylinder of suitable capacity.
- PULSA-PAK** — an electrical control device to permit maintained circuits yet provide a momentary electrical impulse.
- SENSITORQUE** — a torque-sensing unit for control of deep hole drilling operations.
- CARBI-DRILL** — heavy-duty drill unit.
- LUBRI-AIR** — a unit to filter, pressure regulate and lubricate compressed air.
- POWER-DOME** — plain air cylinders featuring dome head construction.

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Would you like to know more about the many models and sizes of Bellows Hydro-Checks? What they are — how they work — how you can use it to obtain precision control of air cylinder movement? Write today for Bulletin HC-600R. Address Dept. TE-959, The Bellows Co., Akron 9, Ohio.



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TOOLS of today

Collet Adapter

Collet adapter, the Rapid-Lok, is designed to speed up tool changes on both horizontal and vertical mills, jig borers, boring bars and other machines. Tool and cutter changing can be accomplished without use of adapters, draw bars or wrenches.



Cutters and tools are held through mechanical leverage produced by internal balls and tapers plus the lugs of the locking lever. Holding pressure is evenly distributed. The collet is available in six styles to accommodate spindle taper on a wide range of machines.

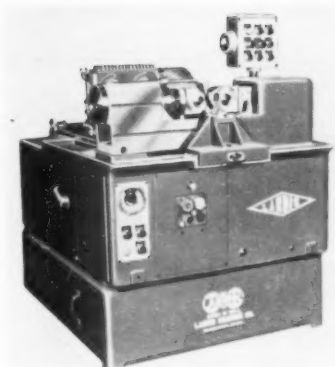
Tree Tool and Die Works, 1600 Junction Ave., Racine, Wis. **Circle 350**

Thread Rolling Machine

Lan-Nu-Roll thread rolling machine handles diameters up to 2 in. (8 threads per in. or finer) with the in-feed method of rolling and up to $\frac{3}{4}$ in. (10 threads per in. or finer) with the through-feed method.

Either hydraulic or pneumatic operation is available. Spindle speeds are adjustable from 166 to 500 rpm.

September 1959



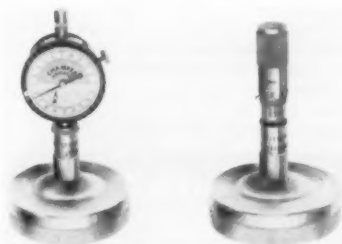
Manual, semiautomatic or automatic cycling are available along with automatic feeding equipment for through-feed operations.

Landis Machine Co., Church and Fifth Sts., Waynesboro, Pa. **Circle 351**

USE READER SERVICE CARD ON PAGE 177 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Chamfer Gages

Gages of 2 and 3-in. major diameter capacity are available in two styles for measuring included angles from 0 to 90 deg and from 90 to 127 deg. The



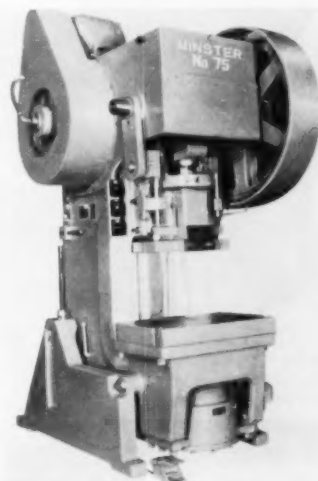
chamfer micrometer gage is used for precise measurement such as control of chamfer depth. A chamfer indicator can be used in cases where speed is essential.

Acme Scientific Co., 1450 W. Randolph St., Chicago 7, Ill. **Circle 352**

O. B. I. Press

Seventy-five-ton, open-back inclinable press has an optional recirculating lubrication system which continuously lubricates main and connection bearings, gibs, gears and counterbalances.

Other improvements of the Series I, No. 75 O.B.I. press are a modified flange slide which gives larger die area



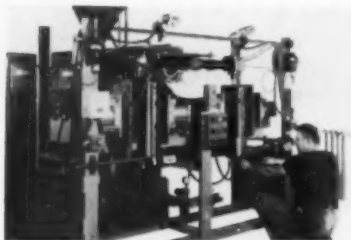
and a lower connection ball box adjustment. The press is available in either flywheel or gear type. It is inclined manually by a double screw arrangement at working height.

The lubrication system is enclosed within the cast-construction frame.

The Minster Machine Co., Minster, Ohio.
Circle 353

Molding Machine

Model 855 blow molding machine is a dual-manifold type designed to make

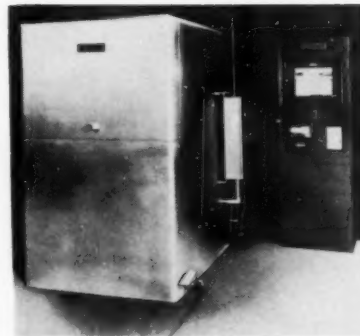


efficient use of the output of any extruder within the range of 1 3/4 to 3 1/2 inches. It is designed for operation on a fully automatic basis and for maximum flexibility in semiautomatic or manual operation. The plastics molder provides a vertical flow-path free of obstruction. The supporting table can be raised or lowered to adapt to molds up to 24 in. high. Mold clearance is 50 in.

F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20, Pa.
Circle 354

Electric Furnace

A door, air-operated by means of a foot valve, is a feature of the model AR gas-tight, controlled atmosphere furnace. Elements operate on 110 v from 220 or 440-v step-down transformers in the base of the furnace. Time switch



and calendar-clock mechanism turn the furnace on or off at any set time.

Waltz Furnace Co., Dept. 25, 1901 Symmes St., Cincinnati 6, Ohio.

Circle 355

WISCONSIN multiple-spindle

Convertible type head for drilling, tapping, spot facing, counterboring



Master Drive Head with Pick-off Gears.

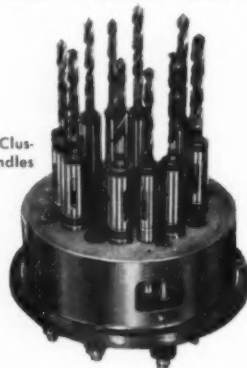


Multiple-Spindle Cluster Plate with Spindles and Idler Gears.

Cluster Box Housing showing Hole Pattern. Can be furnished with round, square or rectangular positioning.



Slip-Type Spindle with Idler Gears used in all convertible-type heads.

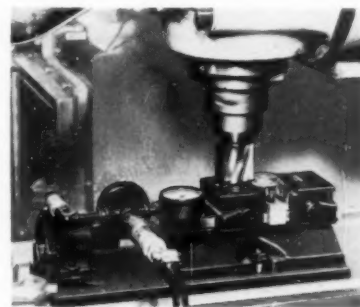


If you have found that *convertible type heads* fit into your production program most effectively, you will want to profit by the experience of the WISCONSIN engineering staff in designing and building heads of this type.

WISCONSIN designs and builds all of the popular and widely used types of drill heads: Standard Multiple-Spindle Adjustable drilling and tapping heads; Fixed Spindle drilling and tapping heads; Rotating Heads; Bracket-Type Universal Joint Drill Heads and special machinery.

Holding Fixture

Shown set up in a machine tool, this contour grip device holds any irregularly shaped part. It can be actuated hydraulically, pneumatically or through



solenoid valves, and can be synchronized with the operation of any machine tool. The fixture is useful in high-speed production operations on millers, profilers, planers, drills, lathes and other machine tools. Available in four sizes with maximum jaw opening from 1 9/16 to 6 3/8 in.

E. W. Bliss Co., Die Supply Div., 1400 Brookpark Rd., Cleveland, Ohio.

Circle 356

Burnishing Barrel

Model XL-1415 is designed for the ball burnishing of jewelry parts, deburring of small metal stampings and castings, and deflashing of plastic parts in either a wet or dry process. The barrel is driven by a 3/4 hp motor. Speed is adjustable from 15 to 45 rpm.

USE READER SERVICE CARD ON PAGE 177 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION



CONSULT OUR FIELD ENGINEERS OR WRITE —

WISCONSIN DRILL HEAD CO.

4985 NORTH 124TH STREET • BUTLER, WISCONSIN
USE READER SERVICE CARD, CIRCLE 66



The barrel is 14 in. in diam, 15 in. long and is lined with 1/4-in. thick neoprene. An upper screen retains work when the barrel is emptied and lets media fall to a lower screen that retains media. Water and compound drain into a tank. Tumb-L-Matic, Inc., St. Mary's St., Stamford, Conn. **Circle 357**

Machine Mounts

This industrial machine mount eliminates the need to lag-down production machinery, and controls vibration and shock. With mobile machinery, an efficient work-flow can be maintained



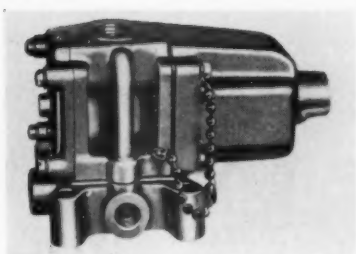
along with maximum machine utilization. The mounts provide high internal damping through use of high-density molded fiberglass materials encased and bonded with neoprene. Model L mounts have a built-in level control feature and are available in three standard sizes to handle load ranges to 8000 lb each.

Consolidated Kinetics Corp., 1065 Dublin Rd., Columbus 8, Ohio.

Circle 358

Air Valves

Particularly applicable to automatic assembly machines and packaging operations is a series of small valves available in a wide variety of models and



mountings. SA Junior air valves will operate cylinders having up to 4-in.

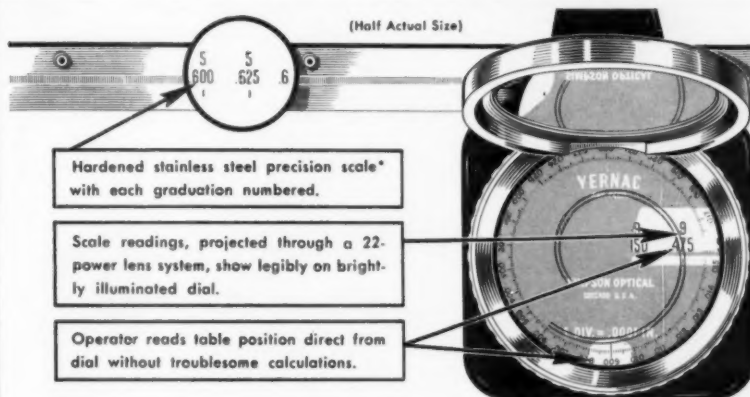
bores in applications where high piston speeds are not a consideration. The valves are recommended for service on vacuum or air pressures to 300 psi. Numatics, Inc., Highland, Mich.

Circle 359

Knuckle Head

Universal ball joint adjustable spindle drilling and tapping head, Model 1100, can be operated with from 2 to 11 spindles and converts any single spindle drill press into a high-production multihole machine.

The knuckle head has a capacity up



New optical measuring instrument assures . . .

high operating accuracy for new or used machine tools

The new VERNAC Direct Reading Optical Measuring Instrument eliminates the complexities of using end rods and gage blocks. Now, the longitudinal, lateral or vertical positioning of machine tool tables can be quickly and easily read direct to .0001". Accuracy is not affected by the wear or stretch of table movement screws. The instrument itself has no moving parts which can impair accuracy.

VERNAC instruments also up-grade machine tools to perform tasks beyond their original accuracy. For example, they can up-grade moderately priced milling machines to the accuracy of more expensive jig boring machines at a fraction of the latter's cost.

*The scale is a replica of a master certified by the U.S. National Bureau of Standards to .0001" maximum error over its entire length.

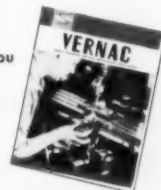
SEND FOR FREE BULLETIN. Explains how the VERNAC enables you to do more precise work on your present machine tools.

VERNAC®

UNITED STATES
AND FOREIGN
PATENTS PENDING

Designed and Manufactured by
SIMPSON OPTICAL MANUFACTURING CO.
3202-04 Carroll Ave., Chicago 24, Ill.

Manufacturers and designers
of precision optics for scientific
equipment since 1926.



9215



Simpson Optical Manufacturing Company, 3202-04 Carroll Ave., Chicago 24

Send me free literature describing the VERNAC Optical Measuring Instrument.

Name _____

Company _____

Street Address _____

City _____

Zone _____

State _____

USE READER SERVICE CARD, CIRCLE 67



to $\frac{3}{16}$ in. in steel and can be set to hole any pattern within a working area

of 6 by 12 in. Aluminum templates can be supplied for fixed spindle setup.

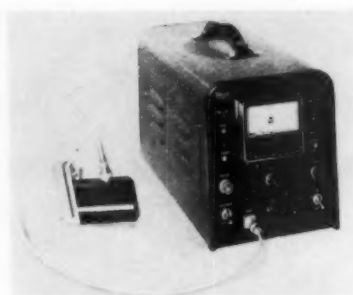
Etco Tool & Machine Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.

Circle 360

USE READER SERVICE CARD ON PAGE 177 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Limit Signalling Comparator

Nine different gage heads are available for the model 765 LSC comparator which can be used with standard height stands or special fixtures for manual inspection or for automatic in-process or post-process gaging and segregation. It permits direct readings from 0.000050 in. per dimension with the type A-1 to



0.001 in. per dimension with the A-20. Full-scale deflection of the meter is a direct 20-v change in the gage output. Setup can be made quickly using any single part of known dimensions, since the gage is linear over the full scale.

Radio Corporation of America, Industrial and Automation Div., 12605 Arnold Ave., Detroit, Mich. Circle 361



Now! before a job is spoiled...

check your surface plates

with a **RAHN Planekator**

(Patent applied for)

NO CALCULATIONS

Anyone who can read an indicator can calibrate a surface plate in minutes with the Planekator!

In effect, the instrument locates a perfect reference plane over the surface plate. All you need to do is to take indicator readings between the reference plane and the surface plate. Record the readings on a chart. It's as simple as that . . . not a single calculation is required!

Ask for demonstration or free trial . . .

RAHN GRANITE SURFACE PLATE COMPANY
641 N. Western Ave. • Dayton 7, Ohio
USE READER SERVICE CARD, CIRCLE 68

Electroplater's Microscope

Designed to provide rapid, accurate measurements of plating thickness, Model AM electroplater's microscope has one 40x coated achromatic objective and one 12.5x filar micrometer eyepiece. Standard equipment includes



monocular body, fixed stage, simplified vertical illuminator, single nosepiece, built-on illuminating unit and transformer. Available accessories convert the instrument into a metallurgical microscope.

Bausch & Lomb Optical Co., 635 St. Paul St., Rochester 2, N. Y. Circle 362

Slitting Shear

Made in three sizes, with capacities for 10, 14 and 20-gage mild steel, the power slitting shear illustrated has two reversible, interchangeable, high-car-

The Tool Engineer



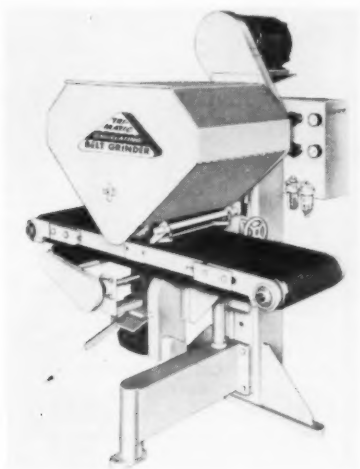
bon, high-chrome cutters driven through steel shafts by a heavy-duty gear set connected to an enclosed worm gear drive.

Etched scales permit direct reading and quick setting of any cutting width from 1½ to 30 in. Beverly Shear Mfg. Co., 3004 W. 111th St., Chicago, Ill.

Circle 363

Belt Grinder

Deburring, descaling, grinding and polishing can all be accomplished on the Tri-Matic oscillating belt grinder. Belt oscillation is maintained and controlled by air-jet sensing. Oscillation



is accomplished without changing the length of the belt path and without undue tension on the belt. Conveyor table height is adjustable, allowing work-belt clearance from 0 to 5 in. from conveyor belt to abrasive belt.

Sales Service Mfg. Co., 2363 University Ave., St. Paul 14, Minn. Circle 364

Drill-Mill Grind Head

Designed to operate as an automation or conversion tool, this unit eliminates the necessity of several single-purpose

develop your angles
and repeat them!

ALINA SELECT-O-POINT drill grinders



Designed for rapid and accurate grinding of:
Twist Drills • Sub Land Drills • Step Drills
• Spot Facing Cutters • Keyway Milling
Cutters • End Mills • Reamers • Screw Taps
• Engraving Needles, etc.

Three models to choose from — No. 01-2 Range .004" thru .080" — No. 03-6 Range .012" thru .250" — No. 2-32 Range .080" thru 1.250". Each machine is a complete system built around a *planned drill point*. Applied to twist drills, this new drill point will increase the useful life of your drills — reduce the drill thrust force — eliminate the need for center punching — produce a rounder and more accurate hole — and on the larger drills afford you a drill point that will produce a round and almost burr-free hole in sheet metal. Fully variable adjustments may be accomplished with a minimum of effort; settings once selected may be altered or repeated *exactly* at any time. Accuracy and simplicity is built into each machine.



WRITE FOR ILLUSTRATED LITERATURE.

ALINA CORPORATION

122 East Second Street, Mineola, Long Island, New York

Alina Corporation, 853 East 8 Mile Road, Detroit 20, Michigan
Jerico Inc., 4744 West Lake Street, Chicago 44, Ill.

Harry M. Smith & Assoc., 1341 Old County Rd., Belmont, Calif.

W. F. Wolf Machinery Co., 2910 Santa Fe Ave., Los Angeles 58, Calif.

Lemuel R. Lance, Inc., Fifth & Courtland Sts., Phila. 40, Pa.

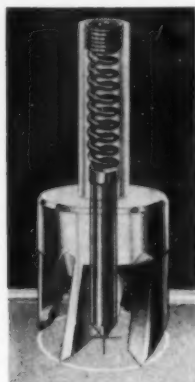
USE READER SERVICE CARD, CIRCLE 69





Boring Tool

Undistorted burr-free holes in very thin plastics, metals, fibers and rubber can be produced with this boring tool.



tools. It may be mounted in fixed or building block machines for drilling, tapping, milling, boring or honing, or on lathes, planers, or mills.

Specifications include a weight of 50 lb; 1½-hp, 3-phase continuous-duty motor; over-all 18-in. length; and speed range of from 300 to 3000 rpm. Mounting brackets, slide assemblies and belt idler are available.

Larmet Co., 108 Wiggs St., Griffith, Ind. **Circle 365**

Air Valve

A series of three-way valves is intended for single or double solenoid operation or for single or double pilot operation.



Sized from ¼ to ¾ in. inclusive, they are of the balanced spool type, direct operated, and function as two-way or three-way valves either normally open or closed to pressure. They can be used as selector or directional valves.

Air Valves Co., 24581 Groesbeck Hwy., Warren, Mich. **Circle 366**

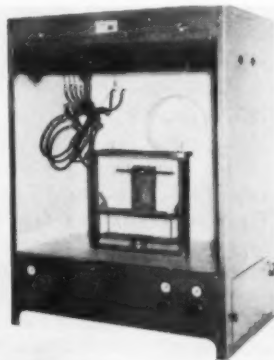
USE READER SERVICE CARD ON PAGE 177 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

It can also be used on heavy-gage sheet and plate materials and in tubing and pipe. Sizes from 3/16 to 2 1/32 in. in increments of 1/64 in. and with either straight or morse taper shanks are available.

Jancy Engineering Co., 508 South Pine St., Davenport, Iowa. **Circle 367**

Spray Machine

One, two or three surfaces of generally oval or rectangular pieces of varying length can be painted with this automatic spray machine which provides fine mask definition and paint de-



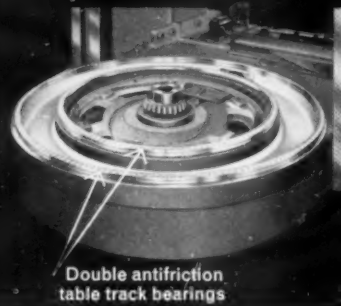
marcation. Length and speed of stroke are adjustable. Overhead traveling guns can be directionally tilted or can be set to remain motionless.

Air operated, the sprayer can be connected with an existing exhaust system, or fan and motor can be supplied. Filtering, lubrication and water trap ejector are automatic. (Cont. on p. 162)

**No heat distortion
and more power
in the cut with
G & L table and bed
construction**



Single anti-friction table track bearings



Double anti-friction table track bearings

G&L vertical boring mill tables ride on a large preloaded, tapered roller center bearing and one or two anti-friction roller bearing tracks. The center bearing prevents misalignment of table and work due to radial thrust. Preloading of the bearing eliminates need for clamps and hold-down devices to prevent table tilting during machining.

Use of single or double roller tracks depends on loads—a second track increasing capacity fivefold. For example, the 12-ft VBM readily handles 125-ton workpieces across its entire speed range.

Unitized bed and transmission assure a level, smooth-running table and eliminate need for a pit because internal adjustments can be made from the top.

All this adds up to less friction, less heat, freedom from distortion, and more power in the cut.

symbol for

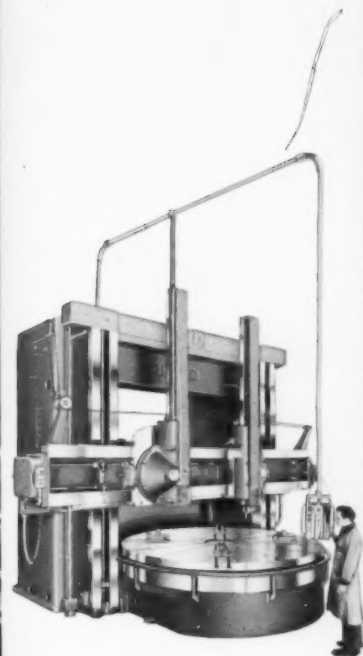
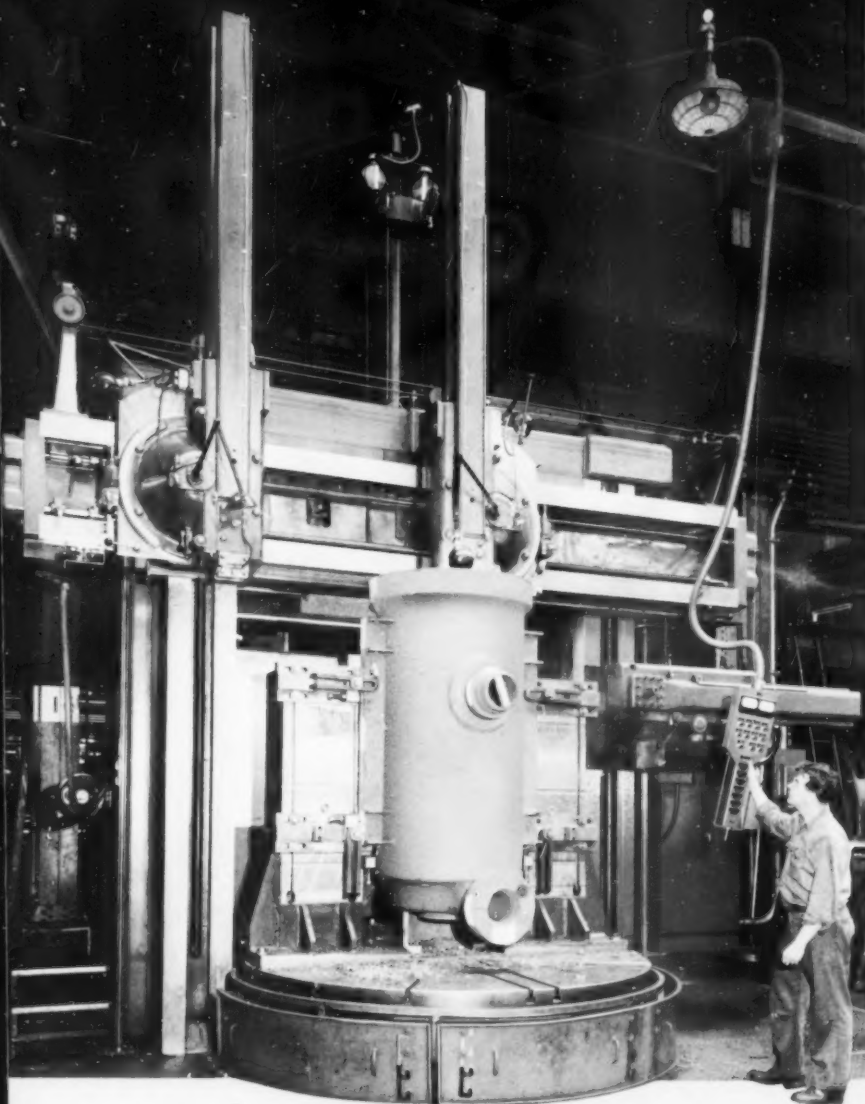
machining cost reduction

GLP-111

USE READER SERVICE CARD, CIRCLE 70



The Tool Engineer



Standard sizes
54-inch through 20-foot

Photo courtesy Allis Chalmers Manufacturing Co., West Allis, Wisconsin

G&L roller bearing table tracks speed up precision machining on any size workpiece

You can turn out any job faster on a Giddings & Lewis vertical boring mill because of the table and bed construction described at the left.

You can run at higher speeds or heavier feeds or both because more horsepower is put to work at the tool and less is consumed in turning the table. The low friction and

resulting low heat build-up permit you to run any size workload *continuously* without loss of accuracy.

Efficient, accurate operation at highly increased speeds permits use of carbide and ceramic tools, even when turning small-diameter work.

Complete reliability of design has been exhaustively proved—no

Giddings & Lewis antifriction table track has ever failed in service.

For complete information on the antifriction table and the many other features of this productive, completely pendant-controlled machine tool, call your Giddings & Lewis distributor or write for Catalog VBM-4.

GIDDINGS & LEWIS MACHINE TOOL COMPANY

Fond du Lac, Wisconsin

Giddings & Lewis manufactures: vertical and horizontal boring machines, vertical turret lathes, planers, planer mills, contour milling machines, die sinking machines, drilling machines, numerical and tracer control systems, boring tools and related items, and machine tool accessories.



low friction · high finish

Stuart's CODOL

liquid grinding compound



Grinding experts will tell you there's only one way to get a slick surface finish without going to extremely fine grit wheels or a straight grinding oil—and you don't have to give up wheel life or cooling action to get it.

That is by utilizing the balanced lubricating and scrubbing action of a water-mix like Stuart's Codol liquid grinding compound. For Codol's balanced formula provides the high surface finish advantages of a straight oil . . . in colloidal form . . . plus the cooling capacity of water.

Extremely fine oil particle size results in a near-transparent solution. Codol is not an opaque emulsion like most soluble oils . . . yet, it has none of the machine maintenance disadvantages of transparent compounds.

Use Codol for fine-finish grinding when you want to keep wheel inventory costs at a minimum and production efficiency right at peak.

Read on the opposite page how Codol helped solve a tough finish problem at International Business Machines Corp.

Stuart's Codol combines lubricity with detergency, for fine-finish grinding



Extremely fine oil particles in Codol serve to reduce the clearance between wheel grits and make a grinding wheel act softer.

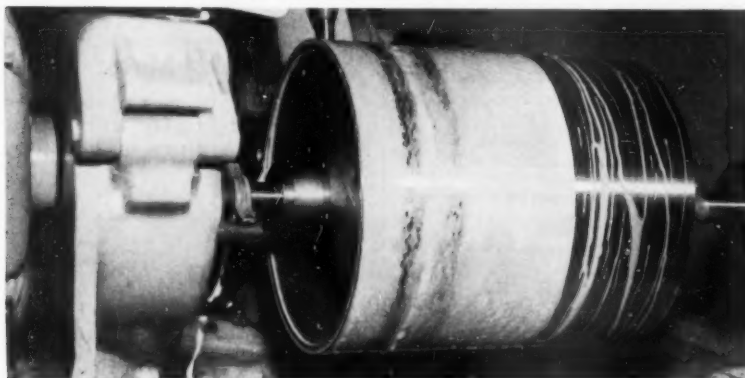
Standard wheels grind like fine-

grit wheels—produce mirror finishes that cannot be duplicated if you rely strictly on grit action. Thus, greater wheel versatility reduces your inventory costs and simplifies wheel stocking problems. But, real benefits come from improved performance of the machine and wheel... as well as from improved product quality.

Codol keeps a wheel open and free-cutting. It's a real detergent. You don't have to worry about heat-stressing. ▼

Stuart's straight grinding oils and new, highly detergent, petrochemical solution, Hi-D—your Stuart representative can provide the grinding fluid best suited to your particular work.

Proof of performance—At International Business Machines Corp., the problem for Codol was preparing the plating surface on 10 in. OD "memory units" (below) used in data-processing equipment. To produce a surface free of roughness or dimensional inaccuracy, the monel drums are precision ground, removing .008 in. stock and holding concentricity within .00025 in. Stuart's Codol provides the lubricity and high detergency required for producing a smooth, mirror-like finish, plus the cooling capacity required for accurate stress-free grinding. After grinding, the drums are copper-plated and turned with a diamond point.



Yet, Codol will not remove way lubricant or attack the finish of machine tools. This adds up to fine finishes, good wheel life, less downtime for dressing wheels, and lower machine maintenance.

With Codol to fill the gap between

(Complete details are available on this application—ask for Bulletin #8.)

Call your Stuart representative for expert advice on grinding fluid problems—and remember, it's Codol when you want a slick finish.



Stuart Productive Lubrication

(Phone Stuart Representative listed at right)

D. A. STUART OIL CO., LIMITED

2727 South Troy Street, Chicago 23, Illinois • Phone: Bishop 7-7100

CANADIAN D. A. STUART OIL CO., LIMITED, P.O. Box 430, 43 Upton Road, Scarborough, Ontario, Canada

USE READER SERVICE CARD, CIRCLE 71

ATLANTA, Georgia

Henry E. Perkins
275 Danbury Lane
Blackburn 5-6926

BAYONNE, New Jersey

D. A. Stuart Oil Co., Ltd.
P. O. Box 137
HEmlock 7-0151

CINCINNATI 2, Ohio

c/o Queen City Warehouses, Inc.
42-56 Main Street
Parkway 1-3731

CLEVELAND 13, Ohio

D. A. Stuart Oil Co., Ltd.
1730 Train Avenue
PRespect 1-7411

DALLAS 35, Texas

The Royal Supply Company
6626 Maple, P. O. Box 35374
Fleetwood 1-3927

DAYTON 2, Ohio

c/o Union Storage Company
10 S. Conover Street
BAldwin 6-1871

DETROIT 4, Michigan

D. A. Stuart Oil Co., Ltd.
8350 Military Avenue
TYler 7-8500

ENGLEWOOD, Colorado

Western Oil Supply
3275 S. Santa Fe Drive
SUNset 1-1721

FORESTVILLE, Connecticut

D. A. Stuart Oil Co., Ltd.
c/o Paul's Cartage
215 Fredericks St.
JACKson 7-1144

HARTFORD 13, Connecticut

D. A. Stuart Oil Co., Ltd.
410 Asylum Street, Rm 336
JACKson 7-1144

HOUSTON, Texas

Ada Oil Company
6910 Fannin, P. O. Box 844
JACKson 6-1911

INDIANAPOLIS 7, Indiana

D. A. Stuart Oil Co., Ltd.
c/o Merchandise Whse. Co., Inc.
1414 South West Street
MElrose 2-2525

KANSAS CITY, Kansas

Interstate Oil Co.
87 Shawnee Avenue
DRexel 1-3470

LOS ANGELES 22, California

Los Angeles Oil & Grease Co.
2313 Yates Avenue
RAYmond 3-1208

MINNEAPOLIS 4, Minnesota

The Satterlee Company
2200 E. Franklin Avenue
FEDeral 3-5264

PHILADELPHIA 35, Pennsylvania

D. A. Stuart Oil Co., Ltd.
Wingate & Hagerman Streets
DEVonshire 8-6100

PORTLAND 4, Oregon

J. E. Haseltine & Co.
115 S.W. Second Avenue
P. O. Box 3342
CAPitol 8-7511

ST. LOUIS 10, Missouri

Jenkin-Guerin Inc.
4480 Hunt Avenue
OLive 2-2905

SAN MATEO, California

Bay City Oil Co.
968 S. Bayshore Blvd.
DIamond 3-2090

SYRACUSE, New York

c/o Robert M. Haley Warehouse
404 N. Midler Avenue
Box 61, Eastwood Sta.
HOward 3-8647

SCARBOROUGH, Ontario, Canada

Canadian D. A. Stuart Oil Co., Ltd.
P. O. Box 430, 43 Upton Road
PLYmouth 7-3227

EUROPE

SWITZERLAND, Bern

Walo v. Muhlenen
Efingerstrasse 75

BELGIUM, Brussels

Ets. Mottay & Pisart S.A., 65 rue du Lombard

DENMARK, Copenhagen-Gentofte

Firma P. V. Nordentoft, Brogaardsvaenge 1

ENGLAND, London W. 1

Amber Oils, Ltd., 11A Albemarle St.

FRANCE, Paris 17e

Dasco S.A., 2, rue Gounod

GERMANY, Frankfurt a.M.

D. A. Stuart Industrielle G.m.b.H.
Cassellastrasse 31

ITALY, Milan

Univers S.p.A., Via Valvassori Peroni N. 47a

SWEDEN, Stockholm—Vartan

A. B. Gullander & Co., Postfack

SWITZERLAND, Bern

N. v. Muhlenen G.m.b.H., Schlosstrasse 131

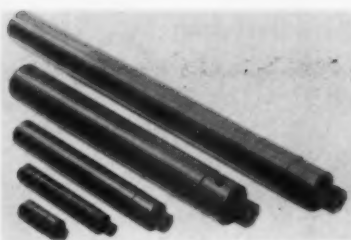
Standard gun mounting rods can be used on this Model SVF machine.

Conforming Matrix Corp., 381 Toledo Factories Bldg., Toledo 2, Ohio.

Circle 368

Jig Legs

Assembly of four jig legs on a plate provides a method for making simple plate jigs. Leg ends and rest buttons are hardened. Large bearing surface at leg top gives lasting accuracy. Large rest buttons provide adequate clearance to protect jig bushings and heads on the top side, and provide more bearing



surface for spot facing or counterboring on opposite side.

Jergens Tool Specialty Co., 712 E. 163 St., Cleveland 10, Ohio. Circle 369



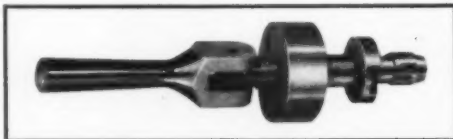
**LOCATION
TOLERANCES
OF .0004"**

with **SPEEDGRIP**
expanding locators

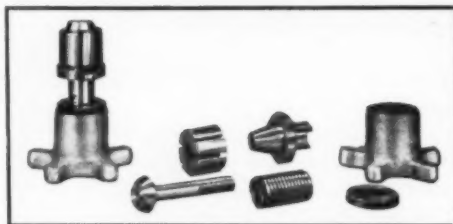
Gain accuracy—Save time—Avoid errors in loading or unloading work from fixtures! Speedgrip expanding locators are guaranteed to repeat fixture loca-

tion within .0004". Nationally known customers find Speedgrip locators indispensable for holding required tolerances! Assures easier loading and unloading of work.

No. 0 Speedgrip Locator with cam lever actuation. With corresponding bushings, this locator will accommodate bores from 1/2" to 3/4" dia.



No. 2 Locator with hand knob actuation. With expansible bushings, this locator can be used for bores from 1" to 2" dia.



This No. 5 locator can be supplied for either wrench or draw bar actuation. Has precision ground pilot on under side of flange for mounting to fixture. With expansible bushings, this locator can accommodate bores ranging in size from 5" to 11" dia. Locators, with various means of actuation can accommodate bores, ranging from 3/8" to 11".

Some Open Territory • Dealer Inquiries Invited

FREE!

Write for Bulletin No. 27 for full description and technical details.

SPEEDGRIP CHUCK

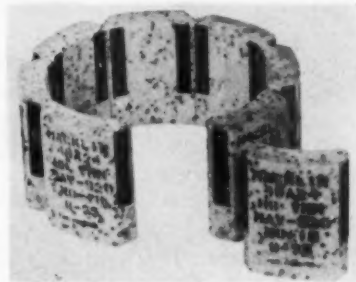
Division of **ERNEST, HOLDEMAN & COLLET, INC.**
Elkhart, Indiana

USE READER SERVICE CARD, CIRCLE 72

USE READER SERVICE CARD ON PAGE 177 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Segmented Wheels

Abrasive and segmented wheels increase production on the grinding of carbides, cast iron, and hard-to-grind steels. In MM process wheels, fine abra-

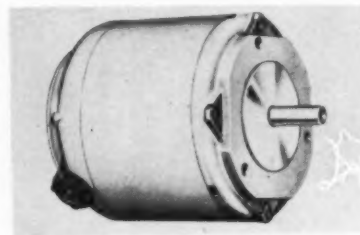


sive pellets function as a cooling element and release a flow of loose abrasive between wheel and work.

Macklin Co., 2914 Wildwood Rd., Jackson, Mich. Circle 370

Synchronous Motor

Called Slo-Syn, an enclosed permanent magnet type synchronous motor is adaptable to a variety of applications

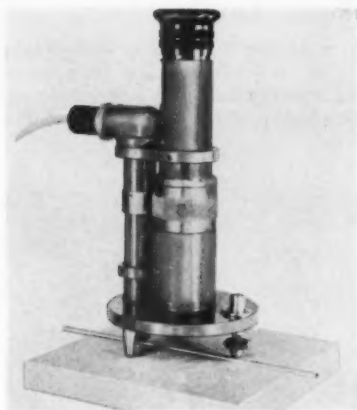


including servomechanisms, automatic machines, remote control and numerical control systems. At 60 cycles the speed remains at 72 rpm without gear reduction. Torque is rated at 150 in.-oz. Dimensions are 4 1/4 in. diam and 4 3/4 in. depth. Weight is 6.5 lb.

The Superior Electric Co., Dept. SS, Bristol, Conn. Circle 371

Microscope

Attachments for the Hilger and Watts scratch investigation microscope permit measuring of scratches and pits on external surfaces of extruded metals with diameters ranging from 0.125 to 3 in.

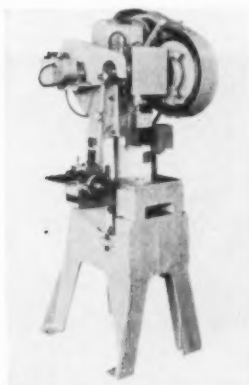


The instrument can be used on flat or curved surfaces, is easily portable and may be used with battery powered illumination. Range of measurement is from 0.0005 to 0.012 in.

Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill. **Circle 372**

Bench Press

Built to operate at 450 to 900 spm, this bench press has a capacity of 5 tons, a dovetail slide or round shank hole and a counterweighted shaft. Devel-



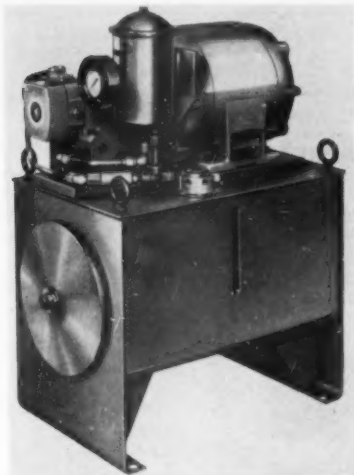
oped for the fabricating of small precision parts, it has a $\frac{3}{8}$ -in. eccentric stroke, a shut height of 8 in. and an automatic lubricating system. Equipped with an electrically controlled air clutch, the press is driven by a $1\frac{1}{2}$ -hp motor.

Emhart Manufacturing Co., Hudson Div., Hudson, N. Y. **Circle 373**

USE READER SERVICE CARD ON PAGE 177 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Power Package

This hydraulic unit, the T10 10-gallon power package, is suited to a variety of industrial machinery uses such as gaging, transferring, indexing and other low horsepower applications.



The basic reservoir is regularly equipped with clean-out covers, fluid level indicators, breather, filter, baffle and drain plug. Optional features include a return line filter with bypass check valve, a pressure line bypass filter, extra breather and extra oil-level indicators.

The package will accommodate the V-104 and V-114 balanced-vane pump and the VV1 5-gpm variable-volume vane pump.

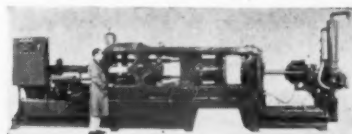
Vickers, Inc., Detroit 32, Mich.

Circle 374

Die Caster

Aluminum die casting machine, the HP-450X-SF, delivers 450 tons of clamp and provides a die opening stroke adjustable from 8 to 30 in. It will produce deep draw aluminum parts weighing up to 16 lbs. The injection shot end of the machine is adjustable from center to 6 in. below center. Height is controlled by a hydraulic elevating device. Support bars of the injection end are level for automatic ladling adaptations. Shot pressure and shot speed are adjustable.

Maximum die height is 30 in., adjustable to a minimum die height of 8



**A FAST,
ACCURATE GAGE—
WHERE AND WHEN
YOU NEED IT!**

The MICROtrol* 170 is a transistorized gaging system for use at the machine, in the gage laboratory or on the production line. Production personnel find it simple to use. The four types of gage heads available can be used interchangeably with the battery-powered amplifier.

Features

- Only 2 control knobs
- One adjustment zeros both scales
- Large meter with 4.6" scale
- Dual range—from either $\pm .0003"$ to $\pm .003"$ or $\pm .001"$ to $\pm .010"$
- Accurate—transistorized throughout
- Pocket-sized— $5\frac{3}{4}"$ square by $\frac{3}{16}"$
- Mounting adapters and gage head stored in cover
- Carrying case handle doubles as amplifier stand
- Lightweight—weighs only 3 lbs.
- Battery powered—can be used anywhere
- AA dry cells can be used in emergency
- Gage heads interchange quickly and easily

Basic System, complete with gage head and amplifier...only \$340.00

*Trade Mark

Contact your nearest Cutler-Hammer office or—Order Direct from

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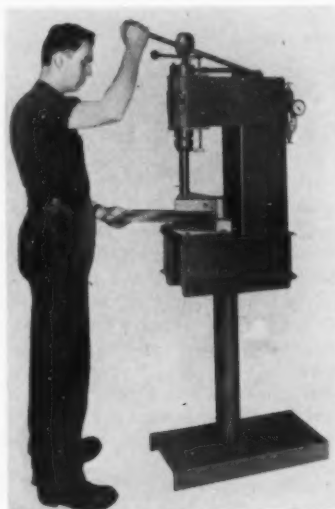
in. with aid of 3, 6 and 9 in. spacer rings. Total daylight is 60 in. Complete machine cycle at the 8-in. die opening adjustment is 6.7 sec and at the 30 in. adjustment is 8.5 sec.

Lester-Phoenix, Inc., 2711 Church Ave., Dept. N-31, Cleveland 13, Ohio.
Circle 375

USE READER SERVICE CARD ON PAGE
177 TO REQUEST ADDITIONAL TOOLS
OF TODAY INFORMATION

Bench Arbor Press

An air-actuated, fast ram approach is a feature of this 10-ton hand-operated hydraulic bench arbor press. Adaptable to a wide range of bending, straightening, forming and punching



applications, it can be operated at 20 strokes per minute on an air supply of 50 psi.

Operating lever is adjustable to individual needs. A pressing plate and two matched V-blocks for straightening and bending operations are included with the press.

K. R. Wilson, Inc., Arcade, N. Y.

Circle 376

Epoxy Adhesives Kit

Select-A-Pak, including two clear resins and one filled resin, two one-component systems (liquid and thixotropic nonflow paste), one epoxi-patch kit, and five hardeners, allows prospective users of epoxy adhesives to evaluate a complete range of resins and hardeners.

Houghton Laboratories, 322 Houghton Ave., Olean, N. Y.
Circle 377

Roller Leveler

A double-tilt backed-up roller leveler is one of a line designed for precision flattening and correcting of ferrous and non-ferrous sheets and strip, including



tension leveling of coil stock. Sizes are available for all modern metals of any required width and in gages from 0.001 to 0.750 in. Levelers may be used in process lines, cut-to-length lines or tension leveling lines.

Sutton Engineering Co., First National Bank Bldg., Pittsburgh 22, Pa.

Circle 378

Barrel Finishing Media

A truncated pyramid shaped media, called "Honite" brand Z-N Tumbling

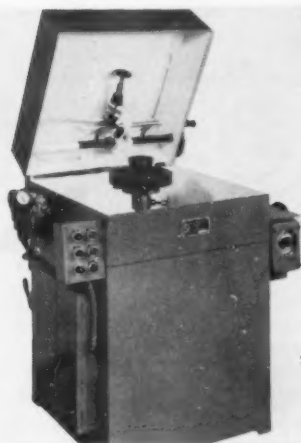


Shape, is designed for zinc die castings. It offers fast cutdown, produces a low microinch surface finish and protects workpiece against surface impingement.

Minnesota Mining and Manufacturing Co., Dept. F9-308, 900 Bush Ave., St. Paul 6, Minn.
Circle 379

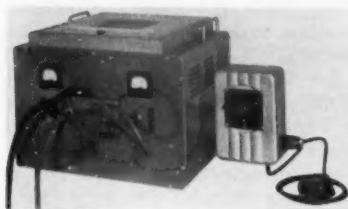
Gear Deburring Machine

Semiautomatic, self-contained unit removes machining burrs from spur, helical and bevel gears. The work spindle rotates the gear at the desired speed (1 to 5 rpm) and the floating wheel spindle allows the wheel to automatically follow the gear tooth profile, de-



Generators

Small vacuum type high-frequency heating units, weighing less than 80 lb., are intended for laboratory and light



production functions. Model L4C induction generator puts out ½ kw for heating metals. Model C-63 dielectric generator puts out ½ kw for heating nonconductors such as plastic and resins.

Reeve Electronics, Inc., 609 West Lake St., Chicago 6, Ill. **Circle 382**

Bleeder Valve

Valve No. 70-VR can be used at either end of any cylinder to bleed air from another piece of equipment as the rod on the cylinder reaches the end of its

burring the entire form. No change gears, followers or templates are required. This operation can be performed regardless of the hardness of the gear.

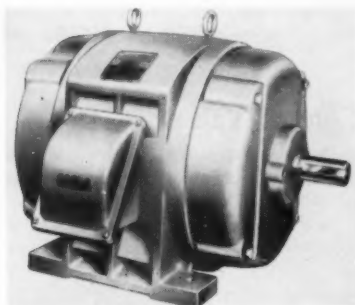
The Model 20 machine has a work-loading height of 37½ in. It requires 40 by 47 in. of floor space. Standard operating voltage is 220/440 v, 3-phase, 60-cycle current.

Redin Production Machine Co., 2433 20th St., Rockford, Ill. **Circle 380**

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Rated Motors

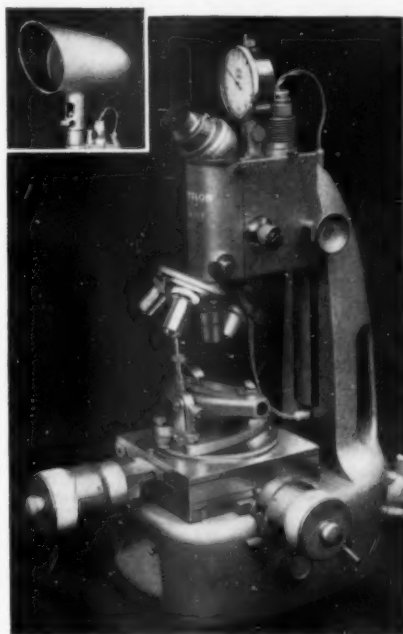
Illustrated is one of a line of drip-proof electric motors in new NEMA rated frame sizes, from ½ hp at 900



rpm through 150 hp at 3600 rpm. Three or two phase motors are available in all frequencies and commercial voltages below 600 v.

Frames are 182 through 445 URS. Lima Electric Motor Co., Inc., Dept. 381, Lima, Ohio. **Circle 381**

MEASURE TO 0.0001" IN 3 DIMENSIONS WITH UNITRON'S TOOLMAKERS MEASURING AND METALLURGICAL MICROSCOPE



The UNITRON Model TM is more than just a measuring microscope. It is the only instrument which combines in one stand a completely equipped toolmakers microscope for precise measurements — LENGTH, WIDTH and DEPTH, and a metallurgical microscope for examining the structure of polished metal samples under high magnification.

NOTE THESE QUALITY OPTICAL & MECHANICAL FEATURES

- **Objectives:** achromatic, coated, 3X, M10X, M40X.
- **Eye-piece:** coated K10X with crosshair.
- **Magnifications:** 30X, 100X, 400X; up to 2000X with accessories.
- **Focusing:** Both dual control rack and pinion coarse and micrometer-screw type fine adjustments. Body has locking device.
- **Three Illuminators:** sub-stage, surface and vertical, have variable intensity.
- **Combination Stage:** rectangular ball bearing with linear measurements to 0.0001" and rotary measurements to 5" with vernier. (Metric model available on special order.)
- **Depth Indicator:** measures in units of 0.0001" by "optical contact" with specimen.
- **Projection Screen:** available as accessory for optical comparison.
- **Eye-piece Turret:** available as accessory for measuring surfaces, radii, thread pitch etc.

In fitted hardwood cabinet

\$1050
FOB Boston

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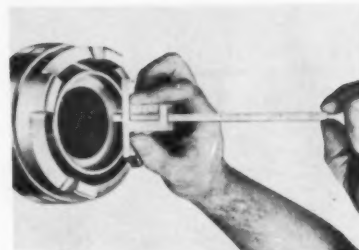


stroke. The valve has a hardened pin that is actuated by a cam-boss mounted

on the piston rod.
Allenair Corp., 255 E. 2nd St.,
Mineola, N. Y. **Circle 383**

Vernier Depth Gage

A 1.255-in. long vernier plate, which provides readings in 0.001-in. increments, facilitates the use of this No. 601 gage. Vernier graduations flush with blade graduations eliminate parallax. A spring pressure clamp holds the blade in position. Slight pressure releases the blade for free sliding to measuring position.



The gage is available with 6 or 12-in. blades or with both, either with or without case.

Brown & Sharpe Mfg. Co., Providence 1, R. I. **Circle 384**

olivetti

high-precision grinding machines with hydraulic automatic infeed for traverse grinding and plunge grinding as standard equipment on all models.



3 types:

UNIVERSAL. Swivelling wheelhead, swing-down internal grinding attachment, infinitely variable speed headstock.

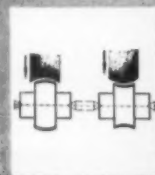
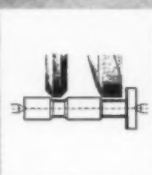
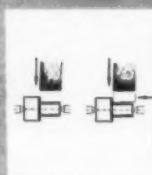
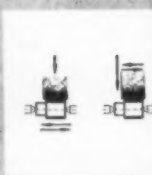
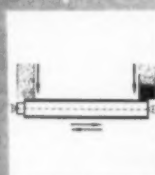
PRODUCTION. Larger grinding wheel, more horsepower, non-swivelling wheelhead, 8-speed headstock.

PLUNGE. Similar to production type but with axially oscillating wheelhead and hand table control only.

4 sizes:

10", 12", 14", and 18" swings (with choice of lengths between centers).

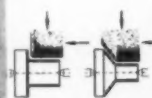
Model R4-500 U shown at left. Universal type, 10" swing, 24" center distance.



SOME STANDARD FEATURES OF OLIVETTI R4 UNIVERSAL GRINDERS:

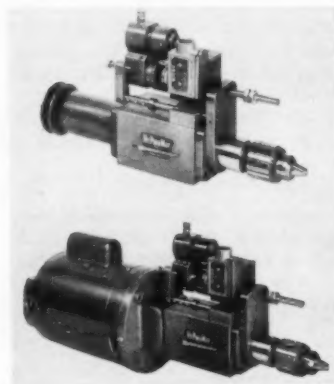
- Infinitely variable hydraulically controlled table speeds
- Table reversals within $\pm .0002"$ as short as 1/16"
- Table dwell 0 to 20 seconds
- Automatic precision infeed to .000050", right, left or both ends of traverse
- Thumb jog for taking .0001" cuts on diameter
- Separate automatic plunge feed 0 to .002"/second to positive stop

For sales, service or information, write Olivetti Corporation of America, 42-33 Northern Boulevard, Long Island City 1, New York Or phone RAvenswood 1-7575.



Drilling, Tapping Units

Automatic drilling and tapping units have a 2-in. stroke with drill and tap capacity of 1/4 in. in steel. Model S-200

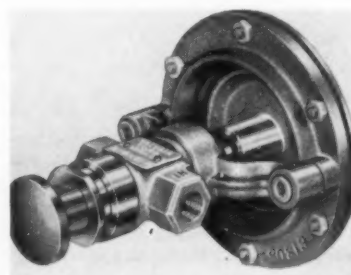


EHB is belt-driven and Model M-200 EHB is motorized, with 1/2 hp and 1800 or 3600 rpm. Optional equipment is available.

Hypneumat, Inc., 647 West Virginia St., Milwaukee, Wis. **Circle 385**

Control Valve

Used in interlocked circuits, this auto-manual control valve can prevent



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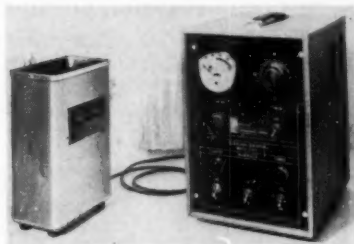
out-of-sequence or accidental manual actuation. In normally automatic circuits, the valve permits manual operation for machine setup or in emergencies. For interlocking, a stock diaphragm end section is fitted to a standard body, with a knob, lever or other type manual control mounted on the opposite end. Manual operation of the valve is unrestricted until air is applied to the diaphragm end.

Valvair Corp., 454 Morgan Ave., Akron 11, Ohio. **Circle 386**

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Ultrasonic Part Cleaner

Model 200 ultrasonic small parts cleaner has a one-gallon stainless steel tank with 43 percent of the bottom



covered with driving elements. Radiating surface is 12 sq in.

The 115 volt AC single-phase 60-cycle generator, designed for continuous operation, has an average power output of 60 watts and peaks of 240 watts. The unit can be adjusted to available line voltage.

National Ultrasonic Corp., 111 Montgomery Ave., Irvington, N. J. **Circle 387**

Air Gage

A column type Precisionaire dimensional inspection air gage has amplifications up to 100,000 to 1. A superamplification kit for use with the instrument provides amplifications of 20,000 to 1 to 100,000 to 1 without changing the glass column. The long gage range permits a large number of part sizes to be classified within a given tolerance range.

The Sheffield Corp., Dayton 1, Ohio. **Circle 388**

Wire Brushing Machine

Illustrated is a tool of the 904 series of portable pneumatic grinders, wire



brushing machines and horizontal buffers. A choice of three speeds is available in the grinders and wire brushing machines: 9 thousand, 7.2 thousand, or 6 thousand rpm.

Thomas C. Wilson, Inc., 21-11 44th Ave., Long Island City 1, N. Y. **Circle 389**

Metric Taps

Produced in all sizes and pitches, metric taps are designed with high spiral flutes and cutting edges. Low torque and high speed are features. The taps are of high-speed steel.

Shearcut Tool Co., 7045 Darby Ave., Reseda, Calif. **Circle 390**

Miniature Gage

Gaging contacts of the small size Arnold grinding gage (model SG) are retracted by a finger grip to permit



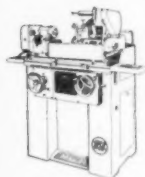
SOLVES Grinding Problems

This is the 94th consecutive year of MSO leadership in the development of improved grinding methods.

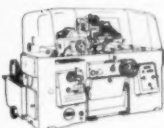
MSO offers unequalled precision in the most advanced grinding machines available anywhere.

Today, when your grinding problems are more complex than ever before, MSO, as always is one step ahead with the solution.

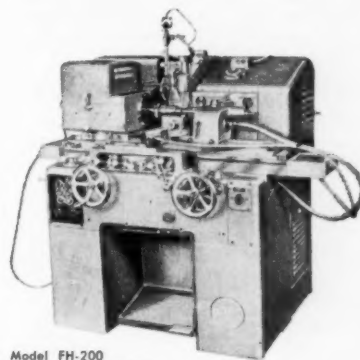
The MSO line comprises a full range of Plain and Universal Grinders, Cap. 7" x 12" to 22" x 138".



MODEL FMES
UNIVERSAL
GRINDER



MODEL GA-2
HYDRAULIC
THREAD GRINDER



Model FH-200
Hydraulic Production Grinder
Capacity: 10" x 16" to 40"

FEATURES:

- Rapid traverse to wheelhead
- Equipped for traverse and plunge-cut grinding
- Selection of 4 automatic cycles with fine finishing feed, adjustable spark-out and automatic cut-out
- Manual and automatic table and wheelhead movement
- Fine feed to .0001" by quick lever trip
- "Precimatic" electric grinding gauge sizes to .0001"

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76-V Mamaronck Avenue

White Plains, New York

AUS-39a

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YODER SLITTERS

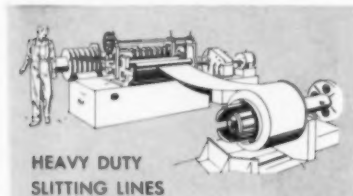
basic equipment for cost-conscious users of strip!

To help meet the demands of tight production schedules, YODER Slitters reduce mill-width stock quickly and economically to desired widths. If your needs are as low as 100 tons per month, time and manpower savings alone will offset the cost of your YODER Slitter in a matter of months, while reducing basic inventories. Compactly designed, standard YODER Slitters are built to handle standard coil widths... completely engineered lines for special requirements.

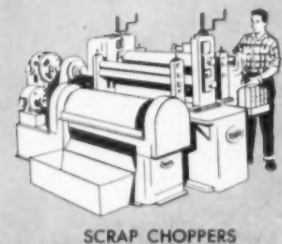
YODER accessories, such as coil cars, swivel unloaders, scrap choppers, scrap disposers, plate levelers and coil boxes, make stock handling fast and easy.

YODER also makes a complete line of Cold Roll-Forming equipment and Pipe and Tube Mills. To profit from YODER'S years of engineering and service experience, contact your local YODER representative or send for the fully illustrated descriptive, YODER Slitter Manual; it's yours for the asking. Write to

THE YODER COMPANY
5525 Walworth Ave. • Cleveland, Ohio



HEAVY DUTY
SLITTING LINES



SCRAP CHOPPERS



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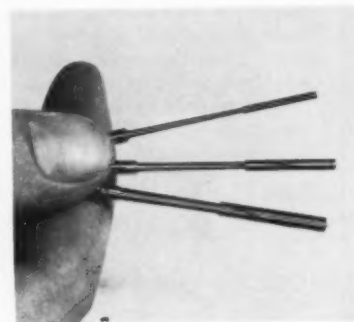


placing the caliper on the work without damage to either the workpiece or gage contacts. Calipers regularly furnished with the gage are adjustable from 0.093 to 0.500 in. Calipers as small as 0.060 in. can be furnished.

Federal Products Corp., Providence 1, R. I. **Circle 391**

Miniature Laps

Helical-slot round hole laps are available in various sizes to finish hole sizes



from $\frac{1}{16}$ to $\frac{11}{64}$ in., in increments of sixty-fourths, with or without interruptions. Special decimal diameters are also available.

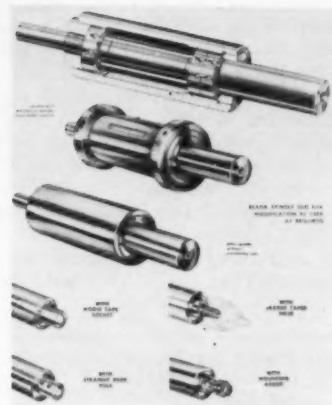
American Lap Co., 20184 Sherwood Ave., Detroit 34, Mich. **Circle 392**

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Spindle Assemblies

Cartridge type, precision spindle assemblies are available in diameters from 1.250 to 2.750 in. Spindles are designed for mounting a variety of small cutting tools such as end mills, shank type and center-hole milling cutters, drills, taps, reamers, counterbores, and slitting saws.

Twenty-eight models offer a range of four basic sizes and two methods of



mounting the spindle to the machine, along with five types of spindle nose.

Russell T. Gilman, Inc., 623 Beech St., Grafton, Wis. **Circle 393**

Centerless Internal Grinder

With the 090 Centri-Matic, inner races of bearings as small as 0.040 in. can be ground to 0.00015 in. tolerance and 5 microinch finish in a fully auto-



mated 15 sec cycle. Practical minimum outside diameter of work is 0.050 in. The shoe type grinder has automatic loading, part sizing and ejection and easily changed tooling.

Heald Machine Co., 9 New Bond St., Worcester 6, Mass. **Circle 394**

Tube Packs

Intended for use as air carriers in automation equipment, extruded polyethylene tube packs containing from 2 to 37 color-coded small diameter air-pressure tubes are encased in abrasion-resistant vinyl compound.

B. F. Goodrich Chemical Co., 3135 Euclid Ave., Cleveland 15, Ohio.

Circle 395

The Tool Engineer

Portable Finishing Barrel

Intended for use in plants processing small lots of parts, the Model DBM-10 Super-Mite is equal in performance to

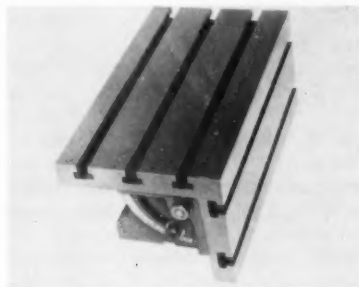


larger barrels. The 12-in. diameter by 8-in. wide barrel has $\frac{1}{2}$ cu ft capacity and is equipped with a quick-acting cam type door. It is driven at speeds variable from 19 to 38 rpm by a 1/6-hp, 110-v motor. Small enough for one man to carry from one location to another, the complete machine measures 26 inches high by 30 inches long by 18 inches wide. Weight is 96 lb.

Queen Products Div., King-Seeley Corp., Albert Lea, Minn. **Circle 396**

Adjustable Angle Plate

Large-capacity Model 160 angle plate has two T-slotted plates. The top plate,

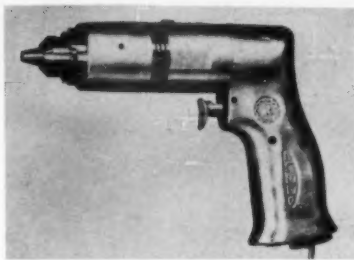


which is 10 by 18 in., is adjustable from zero to 45 deg. The side plate, 8 by 18 in., is adjustable from 45 to 90 deg. A side quadrant is fully graduated for ease of use when making production setups.

Universal Vise and Tool Co., Parma, Mich. **Circle 397**

Portable Air Tool

Three tools in one—drill, screwdriver and nut runner—are combined in the No. 10 series pneumatic screwdrivers



and No. 10 series drills. Complete interchangeability of parts between the series enables each of these tools to perform multiple jobs.

The clutches for these tools are non-friction types that "roll" when a predetermined torque is attained on screw or nut. Torque limit is set by means of an adjustable locking device that posi-

tively maintains the desired limit. Both reversing and nonreversing models are available.

Cleco Air Tools, Houston, Texas.

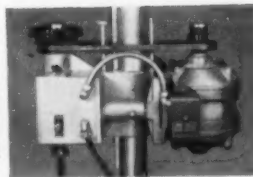
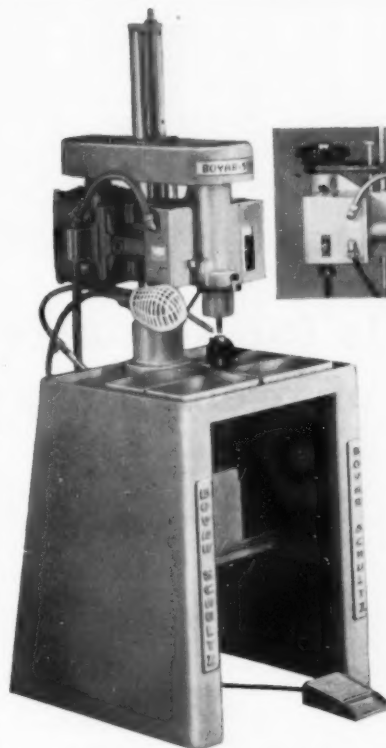
Circle 398

Bore and Groove Gage

Designed to simplify precision inspection of many types of grooves and bores, a deep bore gage is available in three sizes to suit the requirements of various hole depths and diameters. The range covers holes with $1\frac{5}{8}$ to 10-in. diameters and up to 10 in. deep. Interchangeable tips permit three-point inside diameter measurement and two-point outside diameter measurement.

Mueller Gages Co., 1052-1058 North Allen Ave., Pasadena, Calif.

Circle 399



**Three Speed
Timing Belt Drive
Transmits
FULL POWER
To Spindle**

The New Boyar-Schultz LEAD SCREW TAPPING MACHINE

A new general purpose tapping machine designed to fill the need for fast, accurate lead screw tapping. Sturdy, flexible design assures precision tapping through long runs.

Just look at these outstanding features:
Positive drive and positive reversal.
Three speed timing belt drive.
Special 1 H.P. 220 or 440 volt motor with very HIGH REVERSING capacity.

Length of tapping stroke controlled by external screw adjustment.
Large $1\frac{1}{2}$ " diameter lead screw of hardened bearing steel, with precision

ground thread.

Wear compensating (jam free) lead screw nut.

Elevating screw to raise and lower tapping head.

Positive drive from spindle to tap.

Taps positioned in precision collets.

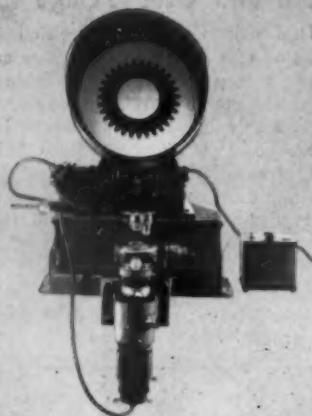
Foot pedal controls automatic tapping cycle leaving operator's hands free to handle work or fixtures.

BOYAR-SCHULTZ CORPORATION

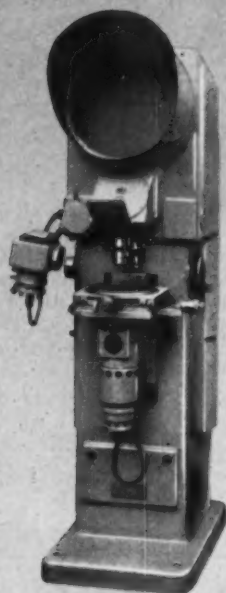
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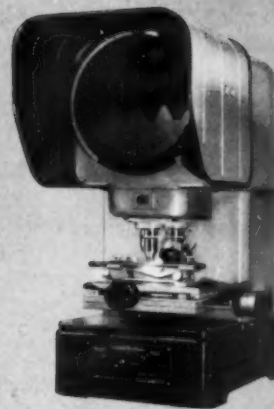
NIKON OPTICAL COMPARATORS



Model II Portable Bench Unit



Model III Floor Unit



Model VI Bench Unit

3 models for accurate inspection of precision parts

Whatever your inspection needs — whatever your budget considerations — there's a Nikon Optical Comparator to meet the demands of both. For Nikon has successfully fulfilled the two most pressing requirements in industry — *outstanding performance at moderate cost.*

Whichever of these three models you select, you will discover the same demonstrable qualities in each: bright screen illumination, sharp edge-to-edge definition, ease and speed of operation, and an almost unlimited versatility. You will be especially impressed with the high accuracy of performance, the simplicity of mechanical design, and the ruggedness of construction.

Nikon comparators may be used for surface as well as contour inspections — simultaneously, if desired. The inherent versatility of the Nikon is even further extended by the availability of a wide assortment of accessories for general and special applications: lenses covering a wide range of magnifications — 8 different stages — goniometers — fixtures — charts — vernier protractor screens — and photo-recording equipment.

NIKON Model II Portable Bench Unit — 12" Screen

Ready portability is one of its major advantages. It can be easily carried from one part of the plant to another for accurate on-the-spot inspections and measurements — with minimum loss of down time. Equipped with 3-lens turret.

NIKON Model VI Bench Unit — 12" Screen

Offers many advanced features: hand-wheel control for fine focusing, built-in illuminator for surface inspection, built-in blower system, bayonet mount for rapid lens interchangeability. Also available with bayonet, 3-lens turret.

NIKON Model III Floor Unit — 12" Screen

A rugged unit of extreme efficiency and accuracy — completely self-contained in cast aluminum housing. Fine movement focusing system employs lead-screw drive with scraped ways and adjustable gibs. Equipped with 3-lens turret.

For illustrated catalog, complete specifications and prices of all units and accessories, write to: Dept. TE-9.



NIKON INCORPORATED • 111 Fifth Avenue, New York 3, N. Y.

Field Notes

A new hall of progress housing a permanent historical presentation that traces the events of the industrial revolution has been opened in Des Plaines, Ill., by the DoAll Co. Assembled in the hall are many authentic, historically-significant inventions, such as man's first practical power plant and an original James Watt steam engine. The hall will be available for meetings of technical and educational groups. Student groups at all levels will be welcome.

✓ ✓ ✓

Patents detailing methods of constructing segmented dies whereby individual interlocking tungsten carbide parts are bolted to a softer metal base were declared public property by the United States Patent Office. Known as the Banko patent, developed by George Banko, the invention was dedicated to the public through the cooperation of Allegheny Ludlum Steel Corp.

✓ ✓ ✓

Wm. K. Stamets Co. has announced a merger with its former wholly-owned subsidiary, The Enterprise Co., Columbiana, Ohio. Executive offices, sales operations and the machine tool distributor division at Stamets Pittsburgh headquarters will be in the Jenkins Arcade Building. Engineering and manufacturing operations of both companies will be combined in the Enterprise Div.

✓ ✓ ✓

Inactive manufacturing facilities in Toledo are to be sold by E. W. Bliss Co. Formerly a metal working press manufacturing plant, the facilities include a 165,000 sq ft Meehanite foundry capable of handling castings weighing up to 60 tons and a 230,000 sq ft heavy machine shop. The plants have been inactive for over a year. Service of Toledo built presses will continue to be handled from the company's other press building facilities at Canton, Ohio, and Hastings, Michigan.

new companies

Organization of Production Machinery Inc., a new company which imports West German metalworking

machinery and markets under the Proma brand name, has been announced. The company maintains a central marketing office in Des Plaines, Ill., and warehouses in Baltimore, Chicago, Los Angeles and Houston. Dealerships are now being assigned to give complete coverage of all U. S. market areas.

✓ ✓ ✓

Segmented Carbide Die Inc., 8129 Lyndon Ave., Detroit, Mich., has recently been formed by Russell Burdell and Ward Bolt & Nut Co. of New York for the purpose of research and development of impact tooling for the cold heading industry.

expansions

Manufacturers of printing and industrial rollers, The Moreland Corp., has enlarged its Willow Grove plant by nearly 30 percent. While the addition is devoted exclusively to the production of large rollers, the new section permits the facilities for small rollers to be expanded into the area formerly devoted to large rollers.

✓ ✓ ✓

Westinghouse Electric Corp. has announced that it will spend more than \$25 million to expand and modernize facilities for the manufacture of turbines, generators, large motors and related heavy apparatus at plants in Lester, Pa., East Pittsburgh and Sunnyvale, Calif. Largest segment of the coast-to-coast program is a \$21 million modernization and rearrangement at the company's steam division at Lester.

✓ ✓ ✓

The Colorado Fuel and Iron Corp. has recently added a new galvanizing line at the wire mills of CF&I's Pueblo plant to meet increasing demands for high carbon, heavy galvanized coated wire. The new galvanizing unit will enable the wire mills to supply greater quantities of heavy galvanized wire. Larger weight and diameter coils can now be furnished.

✓ ✓ ✓

Lenz Co., of Dayton, Ohio, manufacturer of steel tube, pipe and hose fitting products has doubled its plant capacity by expansion of present facil-

ities in Dayton, Ohio. Housed in the expanded plant is production of steel pipe fittings, reusable hose fittings and assemblies for medium and high-pressure applications as well as hydraulic accessories such as benders, tube cutters, tubing, valves and installation tools. An approximate 40 percent increase in employment has resulted from the expansion.

✓ ✓ ✓

Atmosphere hardening facilities of Pittsburgh Commercial Heat Treating Co., a unit of Cox Industries, has been expanded. In operation are two new 4 by 8 ft atmospheric furnaces. This new facility will permit the atmospheric hardening of extremely large parts. The total cost of the new facility is estimated at \$75,000.

association news

A research grant has been awarded to Dr. Fritz V. Lenel, Prof. of Metallurgical Engineering at Rensselaer Polytechnic Institute, to investigate powder metallurgy techniques with lead and lead alloys. The project is part of the over-all research program of the Lead Industries Association. Other investigations underway concern extrusion, lead alloys, fiber reinforced lead, lead (organic) chemicals, ceramic applications, and other special studies.

✓ ✓ ✓

Offices of the Alloy Casting Institute previously located in Mineola, are now located at 1001 Franklin Ave., Garden City, N. Y.

✓ ✓ ✓

Headquarters of the Metal Powder Industries Federation have been moved to 60 E. 52nd St., New York 17, N. Y. The Federation comprises the following trade associations: Ferrite Manufacturers Association, Metal Powder Core Association, Metal Powder Producers Association, Powder Metallurgy Equipment Association, and a technical organization called the American Powder Metallurgy Institute.

moves

AA Tool Co., Inc., distributors for several small metalcutting tool manufacturers have announced a move to a larger location at 185 Hillside Ave., Williston Pk., L. I., N. Y. The move enables them to carry larger stocks of twist drills, taps, dies, reamers and end mills.

CUTS INSPECTION TIME 75%



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*Joseph F. Less, Plant Manager
Taber Instrument Corporation
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R. B. Denison Mfg. Co., manufacturers of heavy duty and precision limit switches, has moved into expanded facilities in Bedford, Ohio. The new plant, near Cleveland has increased manufacturing facilities on one floor, plus warehouse facilities. New address is 386 Broadway, Bedford, Ohio.

acquisitions

Motch & Merryweather Machinery Co. has acquired the Modern Tool Corp., and Radial Cutter Manufacturing Corp. of Elizabeth, N. J. Plant facilities will be moved to Cleveland, Ohio, and made a part of the company's cutting tool manufacturing division. Distribution will be handled through Motch and Merryweather's present organization.

✓ ✓ ✓

Patents and assets of the Teco continuous automatic chip handling system have been acquired by Link-Belt Co. from the Turbine Equipment Co. of New York.

✓ ✓ ✓

Acquisition of Stephen F. Malaker Associates, consultants in the nuclear and electronics fields, was announced by the Cross Co. The wholly owned subsidiary has been renamed Cross-Malaker Laboratories, Inc., and new research laboratories and administrative facilities have been established in Mountainside, N. J.

✓ ✓ ✓

Assets and inventory of B & M Stainless Fasteners, Inc. have been acquired by Albany Products Co., Inc. of South Norwalk, Conn. The former will continue operation as a wholly owned subsidiary with expanded inventories.

✓ ✓ ✓

Principle assets and all patent rights of Buck Mfg. Co. have been acquired by O. S. Walker Co., Worcester, Mass. The new corporation will operate under the same name and continue to do business from its present location in San Jose.

✓ ✓ ✓

Barry Controls, Inc. has announced an agreement to purchase certain assets and the going business of West Point Mfg. Co. of Detroit. The acquisition is to be made through Vlier Engineering Corp., a subsidiary of Barry Controls. The business will be operated as the Wespo Div. of Vlier Engineering Corp.

The Tool Engineer

new activities

Complete service package which will meet all existing government requirements for test equipment calibration has been established by the United States Testing Co., Inc., Hoboken, N. J. The new service is applicable to all measured standards affected by government contracts, including current, voltage, resistance, inductance, capacitors, frequency and temperature.

✓ ✓ ✓

The Torrington Co. announced the appointment of Marshall & Huschart Machinery Co., Chicago, as authorized representative in the midwest for Torrington rotary swaging machines, dies and parts. Marshall & Huschart Co. maintains branch offices in Milwaukee, Rockford and Rock Island, Ill., and South Bend, Ind. They will handle sales and service on Torrington machines in the states of Iowa, southern Wisconsin, northern Illinois, western Indiana and Michigan.

✓ ✓ ✓

Battery and charge service station warehouse to serve the New York metropolitan area is scheduled to open early in the fall by the New York branch of Exide Industrial Div. of The Electric Storage Battery Co. The facility will service and stock Exide industrial lines for motive power, railway, marine aviation, electric utility and telephone applications.

✓ ✓ ✓

Leasing of custom engineered closed circuit television systems in the United States and Canada has begun by Diamond Electronics Div. of Diamond Power Specialty Corp., Lancaster, Ohio. Management of lease contract arrangements will be done in co-operation with American Industrial Leasing Co. of New York City. Lease contracts may include all standard equipment, standard and specialized accessories as desired, cables, spares, applicable purchase taxes, shipping and installation charges.

✓ ✓ ✓

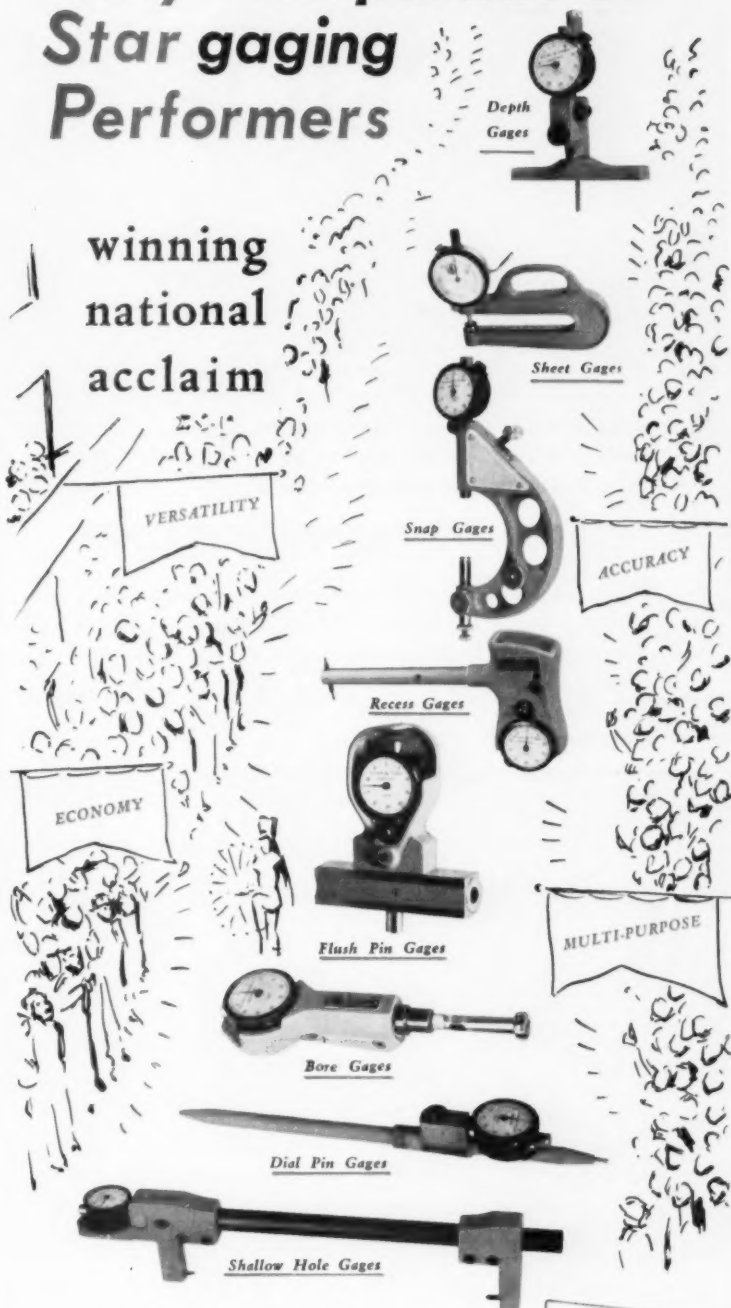
Alina Corp. has appointed Lemuel R. Lance, Inc., Philadelphia, Pa., as exclusive dealer for the eastern Pennsylvania, southern New Jersey and Delaware territory. Lance will stock a complete line of Alina machines.

✓ ✓ ✓

Agreements to manufacturer and market a new electronic system for automated data retrieval were announced by General Precision Laboratory, Inc., Pleasantville, N. Y. and The

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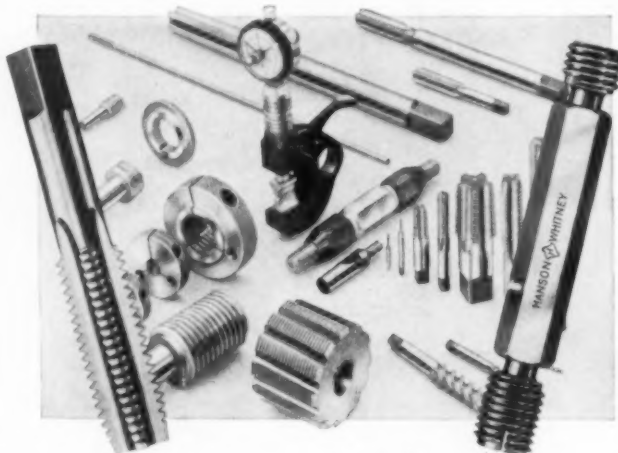
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Fiction:

Beware of fiction in the cheaper threading tool story. The truth is you want more quality threads for your cutting tool dollar. Eliminate the fiction in your cost story caused by production variables which affect your profit dollar. Hanson-Whitney's *complete* line of standard gages and cutting tools, featuring "free-cutting action," insure the consistent quality necessary for a steady flow of quality products.

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What you want is a single source for standard threading tools and gages. It's *fact*, not fiction, that your Hanson-Whitney distributor is the single source for these *quality tools*. *What you want* is a source for complete and related threading service. Your Hanson-Whitney distributor is the threading specialist providing these services—backed up by Hanson-Whitney's forty years of thread engineering and experience.



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STANDARD: Taps • Thread Gages • Cutters • Fine Pitch Gear Hobs

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Filmsort Co., Pearl River, N. Y. Developed by GPL, the system operates within seconds after dialing a code number on a telephone type device to select one file card out of thousands or millions. The automatic equipment can be activated by punched cards, or punched magnetic tape as well as by electronic dialing.

awards

Ten plants in eight industries and nine cities in the United States have been awarded 1959 Honor Citations for excellence in gear production and effective use of modern gear production equipment. Receiving the 1959 awards are two plants of automotive manufacturers, one in the electric motor field, a producer of farm tractors, a manufacturer of road building and construction equipment, a printing equipment manufacturer, a producer of ship propulsion equipment, an outboard motor manufacturer and two independent producers of subassemblies for the commercial and military vehicle field. The awards are sponsored annually by Michigan Tool Co., Detroit, Mich.

new facilities

Expansion of aluminum strip conductor coil winding facilities for prototype and quantity-production coils, was announced by Reynolds Metals Co. The company is adding new equipment and consolidating at its Richmond North plant its coil winding facilities for foil gage and sheet gage strip conductor. Previously the two types of facilities were at separate Richmond locations.

▽ ▽ ▽

An oxygen plant at Great Lakes Steel Corp.'s, Ecorse, Mich. site will be built by Union Carbide Corp.'s Division, Linde Co. The plant will be capable of producing 365 million cu ft of high purity oxygen per month. Approximately 80 percent of the oxygen produced will be used in the open hearth furnace to improve and speed the steel melting process. 10 percent will be used for mechanized scarfing. The remainder will supply other finishing processes and general maintenance requirements.

▽ ▽ ▽

A new plant to produce patented copper-lead bearing powders by a water-jet atomizing process is being constructed at St. Johns, Mich., by Federal-Mogul. The new plant, an addition to existing manufacturing facilities will double present production capacity.

who's meeting and where

Sept. 10-11. SOCIETY OF THE PLASTICS INDUSTRY, INC. Midwest section conference, French Lick Sheraton Hotel, French Lick, Ind. Get more information from society office, 250 Park Ave., New York 17, N.Y.

Sept. 13-25. THE PENNSYLVANIA STATE UNIVERSITY. Technical Report Writing Seminar. More information can be obtained from the Extension Information Office at the university, University Park, Pa.

Sept. 14-17. SOCIETY OF AUTOMOTIVE ENGINEERS. National Farm, Construction and Industrial Machinery Meeting, Production Forum and Display at Milwaukee Auditorium, Milwaukee, Wis. Obtain additional information from society offices, 485 Lexington Ave., New York 17, N. Y.

Sept. 17-18. AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Engineering Management Conference, Statler-Hilton, Los Angeles, Calif. Get pertinent information from society headquarters, 29 W. 39th St., New York 18, N. Y.

Sept. 18. MALLEABLE FOUNDERS SOCIETY. Industry Meeting, Hotel Sheraton-Cleveland, Cleveland, Ohio. More information is available from society office, 781 Union Commerce Bldg., Cleveland, 14, Ohio.

Sept. 20-25. INSTRUMENT SOCIETY OF AMERICA. 14th annual conference with exhibit running coincidentally from Sept. 21 through 25, downtown hotels and International Amphitheatre, Chicago, Ill. Get more facts from society headquarters, 313 Sixth Ave., Pittsburgh 22, Pa.

Sept. 21-22. STEEL FOUNDERS' SOCIETY OF AMERICA. 57th fall meeting, The Homestead, Hot Springs, Va. Get pertinent information from society's office, 606 Terminal Tower, Cleveland 13, Ohio.

September 1959



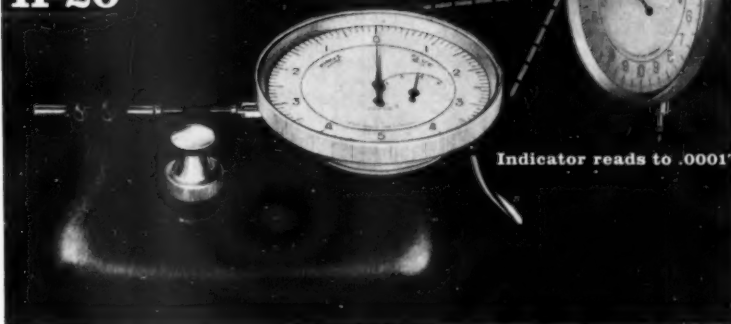
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Insert chasers are like safety razor blades: they cost so little that you can throw them away when dull. Or, for utmost economy, you can resharpen them over and over again. Only a flash grind is required. For approximately \$50 you get a dozen sets of $\frac{1}{16}$ —16 insert chasers, each set ground ready to go. You will be amazed at the quantity of threads they will cut, even to Class 3 specifications, with a minimum of downtime. FREE: "Unified and American Screw Thread Digest"

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The large $3 \frac{1}{4}$ " diameter dial indicator permits rapid, highly accurate readings because of widely spaced and easily visible graduations. The H-20 is equipped with the M-50 dial indicator that can also be furnished separately. This highly sensitive indicator is jewelled at critical wear points and has a range of .120"



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Sept. 21-22. STANDARDS ENGINEERS SOCIETY. 8th Annual Meeting on "Investment in Survival" being held at Somerset Hotel, Boston, Mass. More information available from meeting committee, P. O. Box 538, Wayland, Mass.

Sept. 22-24. ARMOUR RESEARCH FOUNDATION, Illinois Institute of Technology. Third Industrial Nuclear Technology conference, Morrison Hotel, Chicago, Ill. All details may be obtained from M. J. Jans, conference secretary, Armour Research Foundation, Technology Center, 10 W. 35th St., Chicago 16, Ill.

Sept. 21-23. AMERICAN MANAGEMENT ASSOCIATION. Packaging Seminar on how to set up and manage an economical fill control program.

Sept. 24-26. PORCELAIN ENAMEL INSTITUTE. Annual Meeting at the Greenbrier, White Sulphur Springs, W. Va. Obtain complete information from society headquarters, Associations Bldg., 1145 Nineteenth St., N. W., Washington, D. C.

Sept. 28-30. AMERICAN MANAGEMENT ASSOCIATION. Packaging Seminar on packaging line layout. Both programs are being held at Hotel Astor, New York, N. Y. More data available on the programs from association offices, 1515 Broadway Times Square, New York 36, N. Y.

Sept. 28-Oct. 1. AMERICAN WELDING SOCIETY. National Fall Meeting at the Sheraton-Cadillac Hotel, Detroit, Mich. Additional information can be obtained from society headquarters at 33 W. 39th St., New York 18, N. Y.

Oct. 5-10. SOCIETY OF AUTOMOTIVE ENGINEERS. National Aeronautic Meeting, Aircraft Manufacturing Forum and Aircraft Engineering Display, The Ambassador, Los Angeles. Contact society offices at 485 Lexington Ave., New York 17, N. Y. for additional information.

Oct. 6-7. ELECTRONIC INDUSTRIES ASSOCIATION. Conference on Value Analysis at the University of Pennsylvania. More information can be obtained from association headquarters, 650 Salmon Tower, 11 W. 42nd St., New York 36, N. Y.



Gaertner Toolmakers' Microscope used to measure typical piece part. Co-ordinate range 4" x 2".

Precise measurement to 0.0001" and 1 min. of arc Gaertner Toolmakers' Microscope

Here is a reliable, easy-to-use microscope for precise measurement of piece parts, tools, dies, thread gages, templates, jigs, fixtures, etc. Ideally suited for making a wide variety of precision measurements and is especially valuable in reducing rejects in production work.

With the Gaertner Toolmakers' Microscope you make direct, non-destructive measurements — no contact, no distortion, images are sharp and clear. It is a basic measuring instrument for inspection depts., gage labs, tool and die and model shops, industrial and research labs.

The Gaertner Toolmakers' Microscope has been proven in use by U. S. Government Gage Laboratories, and by prime contractors and their subcontractors. With all parties using the same measuring instrument, inspection procedures are co-ordinated and disagreements and rejects minimized.

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- Low, compact built-in rotary stage reads to 1 minute of arc throughout 360° range.
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- Independently rotatable cross hairs in protractor ocular speed up measurements, simplify measuring procedure.
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- Built-in transformer and plugs for all illuminators.

Modifications and accessories to MEET YOUR EXACT REQUIREMENTS

- Thread and radius templates, camera and spotting attachments, fine motion focus, variable magnification available.
- If you have a special measuring problem, our staff of representatives will be happy to consult with you. The service and engineering facilities of the manufacturer are always immediately available to help you.

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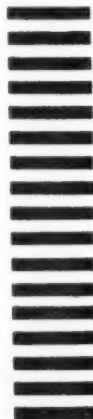
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Trade Literature

for free booklets and catalogs—use request card, page 177

Safety Glasses

A 40-page catalog includes descriptions of plastic, metal and combination safety glasses, specially designed goggles and eye shields and complete specifications for glass and plastic lenses. In addition, information is included on Bausch & Lomb vision testing instruments, ear protectors and a line of safety eyewear glasses. Illustrated with products and in use type photos. Safety Products Dept., Bausch & Lomb Optical Co., Rochester 2, N. Y. **Circle 301**

Welding

Prepared by the Welding Products Div., A. O. Smith Corp., "Who's Who in CO₂" details Smith's three CO₂ processes: semiautomatic hand gun process, fully automatic process, and semiautomatic. Illustrated charts outline typical CO₂ applications from lap joints and fillets to butt and lap welds. For each type of weld the charts detail wire diameters, amperages, voltages, travel speeds, weld positions, and deposition rates. Typical physical and mechanical properties resulting are listed. Bulletin No. MW-253, A. O. Smith Corp., Welding Products Div., Milwaukee, Wis. **Circle 302**

Steel Bars

Mechanical properties analysis and machinability ratings are presented in a series of tables carried out in an 8-page booklet on Jalcase 100, a free machining, stress stabilized, cold finished steel bar. Other factors such as wear resistance, finish, uniformity of hardness, sizes and other heat treatment are also discussed. Public Relations & Advertising, Jones & Laughlin Steel Corp., 3 Gateway Center, Pittsburgh 30, Pa. **Circle 303**

Machine Ways

Containing the latest product information and complete stock specifications, the new catalog details additional standard way and aluminum-bronze way sizes available. A section of the catalog is devoted to center clad hardened and ground standard stock used in electronic and ultrasonic machines. The Ohio Knife Co., Dept. U-97, Cincinnati 23, Ohio. **Circle 304**

Miniature Lamps

Standard line of miniature fluorescent lamps is detailed in new Lite-Mite catalog. Included are hand lights, arm lamps and other standard lighting fixtures. Stocker & Yale, Inc., Marblehead, Mass. **Circle 305**

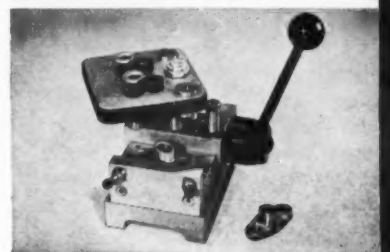
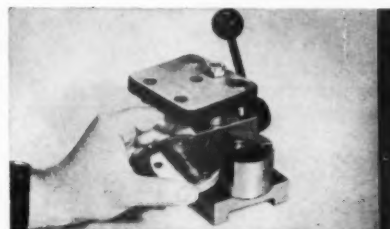
Jig Borers

Pratt & Whitney end measure jig borers are described in new bulletin. Design features and model specifications are described. Pratt & Whitney Co., Inc., Charter Oak Blvd., W. Hartford 1, Conn. **Circle 306**

TOOL QUICKLY

LIFT SWING DRILLING FIXTURE

For Long or Short Runs
Saves Precious Tooling-Up Time
and Fixture Costs



Low Initial Cost

Separately tooled top plates can be used on the same fixture base.

Swing-away top plate permits faster drilling operations, and provides tremendous tooling-up advantages. Take advantage of the "ease of tooling" features.



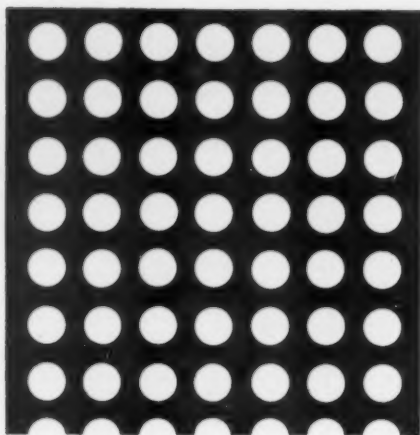
Write for Lift Swing Tooling Suggestions. Bulletin LS-58

ACCURATE BUSHING CO.

ASA Standard Drill Bushings • Precision Parts • Lift-Swing Drilling Fixtures

443 NORTH AVE., GARWOOD, N. J.

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**450 to 900 Strokes
PER MINUTE**



NEW BENCH TYPE HIGH SPEED V & O PRESS

Behind the speed . . . behind that long-slide precision . . . is the sturdy careful construction that has made V & O presses the line in which cost reduction is inherent. Look at the up-to-the-minute features in this eight-ton (Press and Roll Feed) candidate for top honors in high speed performance: electrically controlled air clutch . . . Timken bearing mounted flywheel . . . automatic lubrication . . . bronze pitman . . . 8" shut height . . . 1" max. stroke . . . counter-weighted shaft . . . 450-900 strokes per minute. More information is yours for the asking.



Emhart Manufacturing Co.
Hudson, New York

V & O Presses and Feeds

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EMHART

Descaling Machines

Bulletin No. 609 has photos, diagrams, cutaways and sketches showing details, operating features of the Roto-blast wheels. Various cabinet designs and material handling features appropriate to the type of work being descaled are described. The bulletin covers 4-wheel and 8-wheel machines for descaling sheets, coils and plates, special machines for descaling rods, bars and wire, marginal descaling for pipe skelp, structural descaling equipment for angles, channels, H-bars and I-beams and special installations for descaling billets and slabs. Other sections are devoted to blast stream coverage, operating controls, maintenance factors and abrasive cleaning and recycling equipment. Blast cleaning and pickling processes are compared in regard to initial and operating costs, time, manpower and floor space requirements, automation, quality of finish and other considerations. Pangborn Corp., Hagerstown, Md.

Circle 307

Vibration Isolators

Bulletin No. 59-04 describes vibration and shock isolators and provides data for selection. Barry Controls, Inc., 700 Pleasant St., Watertown 72, Mass.

Circle 308

Air Gages

New 32-page catalog No. 59D describes Dimensionair one-master air gage system and provides specifications on two new air gage models. The bulletin also gives details of various attachments and accessories and instructs on how to apportion gaging ranges to suit tolerances. Catalog is illustrated with application pictures and descriptions. Federal Products Corp., 1144 Eddy St., Providence 1, R. I.

Circle 309

Hoists

Specifications and illustrations of twelve models of new A series air hoists are now available in a four page brochure. Complete data about the 500, 1000 and 2000 pound capacity models are listed. Accessories for both roller and link-chain hoists are described. Bulletin ADH-79, Coffing Hoist Div., Duff-Norton Co., Danville, Ill.

Circle 310

Spray Buffing

Manual on automatic liquid spray buffing contains data on setup and operating procedures for automatic buffing, burring and polishing. Information includes material on recommended abrasive grades, drawing of typical layouts and a section on recommended equipment. Bulletin LIQ-600, The Lea Mfg. Co., 16 Cherry Ave., Waterbury 20, Conn.

Circle 311

O-Ring Seals

A booklet outlines the physical and mechanical considerations of O-ring selection. The book contains engineering data and reference tables simplifying selection, installation, lubrication and maintenance of O-ring seals. It also covers materials, machining and finishes which have consistently proved compatible with superior O-ring sealing. The Auburn Co., Auburn Mfg. Co., Middletown, Conn. **Circle 312**

Plastics

Pocket-sized four-page booklet compares outstanding properties and typical industrial applications of 13 major plastic families in common industrial use. Included are acrylic, Iplex, nylon, Teflon, polyethylene, flexible and rigid vinyl, cellulose acetate, butyrate, polystyrene, high and medium impact styrene, phenolic and fibrous glass reinforced polyesters and epoxies. Cadillac Plastic & Chemical Co., 15111 Second Ave., Detroit 3, Mich. **Circle 313**

Machine Tools

A newly revised 48-page catalog, describing the complete line of Walker-Turner light-heavyweight machine tools and accessories, has been issued. Some of the industrial tools described are Walker-Turner's line of drill presses, grinders, cutoff machines, band saws and belt and disk surfacers. Complete specifications, catalog listing and descriptions of accessories for all tools are included in the catalog. Photos and drawings supplement the text. Rockwell Mfg. Co., Walker-Turner Power Tool Div., Dept. 1009, 400 N. Lexington Ave., Pittsburgh 8, Pa. **Circle 314**

Cams and Camshafts

Four-page booklet entitled, Meehanite Cams, Camshafts and Crankshafts, devotes itself primarily to application problems solved by Meehanite products. In addition, it describes briefly the basic metallurgy and important engineering properties of a few types of Meehanite metal most widely used for such service. Meehanite Metal Corp., 714 North Ave., New Rochelle, N. Y. **Circle 315**

Inconel Tubing

Listed in a four-page technical bulletin on a chemical composition, physical constants and mechanical properties of five materials in tubing form: Inconel, Inconel X, Inconel 702, Ni-o-nel and Incoloy. Minimum and maximum production limits on walls for tubing of various outer diameters from 0.012 to 1.125 in. are listed in a table on the last page. Superior Tube Co., Germantown Ave., Norristown, Pa. **Circle 316**

Automatic Lathe

New 26-page booklet covering the Gisholt Masterline No. 12, 12V, 24 automatic production lathes shows machine features and accessories, as well as floor plans and specifications. Twenty-five actual job applications are shown and explained. Form 1213. Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis. **Circle 317**

Barrel Finishing

"Almco Album of New Products" includes a collection of new Almco catalog literature contained in a double pocket file size folder. Literature covers barrel finishing machines, methods and media. Almco-Queen Products Div., King-Seeley Corp., Albert Lea, Minn. **Circle 318**

Cost Comparison

Metal Parts Finishing Cost Guide is especially designed for determining and comparing costs involved in metals finishing procedures; on premises finishing of parts, off premises finishing of parts and use of prefinished metals. Apollo Metal Works, Dept. TE-3, 66th Place & S. Oak Park Ave., Chicago 38, Ill. **Circle 319**

Welding Accessories

New catalog No. 12 illustrates and describes a complete line of arc welding cable connections and accessories including electrode holders, ground clamps, cable connectors and aluminum welding cable. Tweco Products, Inc., P. O. Box 666, Wichita 1, Kan. **Circle 320**

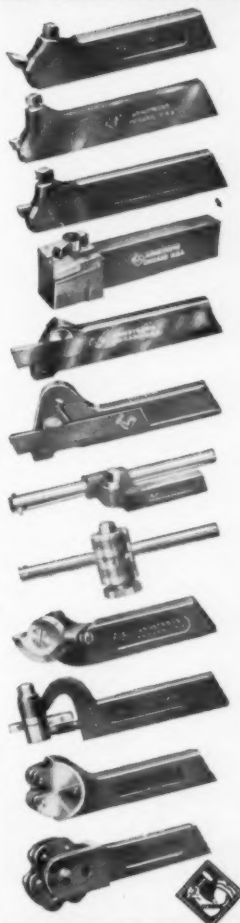
ARMSTRONG TOOL HOLDERS

A Correct Tool for Every Lathe Operation

You can save time (and money) by ensuring that your machine tools are equipped with adequate numbers of the correct ARMSTRONG Tool Holders. The ARMSTRONG System of Tool Holders includes correctly designed tools for every standard operation on lathes, shapers, and planers, and for many operations on turret lathes and screw machines. By utilizing the ARMSTRONG System of Tool Holders, you can reduce tooling costs, eliminate down time in tooling up, operate your machine tools at maximum feeds and speeds.

ARMSTRONG Tool Holders are long-lasting tools. They are strong beyond need, handy and efficient, profitable to use, and are readily available from your local ARMSTRONG Distributor.

Check over your ARMSTRONG Tool Holder needs.
Write for literature.



If you do not know the name of your local ARMSTRONG Distributor, inquire when asking for literature.

ARMSTRONG BROS. TOOL CO. 5257 W. ARMSTRONG AVE. CHICAGO 46, ILL.

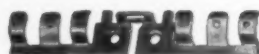
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Blanking, Piercing and Preforming in Press

NILSON 4-SLIDE

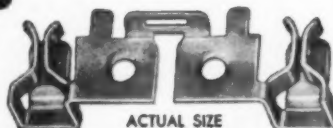
**BLANKS and FORMS
IN ONE CYCLE!**



Cutoff

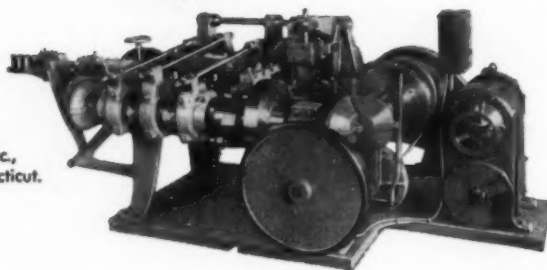


Partial Forming with Slides



ACTUAL SIZE

Final Forming with Slides



Nilson 4-Slide Machine with Built-in Press

MANUFACTURER:
Harvey Hubbell, Inc.,
Bridgeport, Connecticut.

PRODUCT:
Contact Spring.

PRODUCTION:
136 Parts Per Minute.

Harvey Hubbell shifted production of this part from a conventional press and progressive dies to a Nilson 4-Slide with built-in press. The immediate results: elimination of two secondary operations . . . simpler die . . . higher production rate . . . no stripping problems. Harvey Hubbell also found that vertical mounting of die makes replacement easy . . . permits automatic disposal of scrap by gravity. And maintenance costs are incredibly low—this machine

has been operating for twelve years without major repairs!

Nilson builds 7 models of ribbon metal forming machines, with built-in press sections ranging from 5 to 75 tons capacity. One of these machines may help you bring your stamping methods up-to-date!

Write today for the Nilson General Catalog on Automatic 4-Slide Equipment.



NILSON
THE A. H. NILSON MACHINE CO.

606 Bridgeport Avenue • Shelton, Conn.

AUTOMATIC WIRE & RIBBON METAL FORMING 4-SLIDE MACHINES • WIRE & STOCK REELS • WIRE STRAIGHTENING EQUIPMENT • AUTOMATIC STAPLE FORMING MACHINES • SPECIAL WIRE FORMING EQUIPMENT
USE READER SERVICE CARD, CIRCLE 91

Gears

Comprehensive engineering manual titled "Lower Cost Design Begins with Spiroid Gears," has 36 pages. Information contained in the manual assists design engineers in determining basic design requirements such as ratings, selections, center distances, bearing loads, mounting methods, etc. The manual contains several photographs and drawings to illustrate the principle and application of Spiroid gears, a skew-axis gearing system for medium to high reduction ratios. Text includes sections on design advantages, applications, manufacturing and dimensional design data. Spiroid Div., Illinois Tool Works, 2501 N. Keeler Ave., Chicago 39, Ill.
Circle 321

Melting Process

Firth Sterling has released an eight-page brochure on its Hopkins process (Stercon H) melting process. The brochure describes the five melting techniques currently being used. Relative merits of material produced by the Hopkins process are illustrated with photographs of macroetch discs. Included are tables showing physical properties at room and elevated temperatures. Firth Sterling, Inc., 3119 Forbes Ave., Pittsburgh 30, Pa.
Circle 322

High Frequency Induction

Fifth issue of the Lepel "Induction Heating Review" is devoted exclusively to high frequency induction brazing and soldering. It contains a comprehensive story dealing with alloys, fluxes, joint and coil design, production fixtures and typical applications. Lepel High Frequency Laboratories, Inc., Woodside, N. Y.
Circle 323

Indexing Units

Cam operated indexing units are described in a new bulletin by Standard Tool & Manufacturing Co. In addition to drawings of the units featured are tables of indexing positions and cams, results of accuracy tests, and dimensions of standard tooling and dial plates. Included as a primary portion of the bulletin are tables of load rating. Production rate is provided for the three models of indexing units at various loads, stations and dial plates. Standard Tool & Mfg. Co., 237 Laurel Ave., Kearney, N. J.
Circle 324

Rubber Wheels

Technical data handbook on the selection, application and operation of rubber contact backup wheels for abrasive belt grinding and finishing, also includes a section on industrial rollers. Chicago Rubber Co., Inc., 651 Market St., Waukegan, Ill.
Circle 325

technical shorts

The possibility of achieving greater strength and improvements of electrical properties in commercial plastic materials through electrical field processing has been advanced by scientists of Armour Research Foundation of Illinois Institute of Technology.

Plastic Improvement Studied

Preliminary experimentation has shown that processing a commercial plastic such as polystyrene in an electric field at the same time it is subjected to external heating increases the tensile strength approximately 25 percent.

This evidence has prompted ARF electrical engineers to look further into the matter of improving material characteristics of such plastics as polyethylene, polystyrene, and vinylidene chloride. Electrical properties and mechanical properties such as tensile strength, elasticity, and tear strength could possibly be improved, leading to more widespread use throughout industry.

...

Engineers of the R. R. Mahon Co. Industrial Equipment Div. recently built and installed a 172-ft long automatic baking oven which dries hundreds of freshly painted metal signs at a rate equivalent to baking surfaces of 430 auto bodies per hour, or better than seven a minute.

Oven Boosts Paint Drying

The oven is a twin-tunnel type capable of processing 75,000 sq ft. of painted surface per hour, with sign sizes ranging up to 6 by 10 ft. It is reported that there are only two or three ovens in the U.S. appliance and auto industries capable of such performance. The average automotive body paint baking oven handles 45 to 60 an hour.

Innovations in the oven permit it to be used for a double purpose, testing new paints with a wide curing range and placing those selected for use immediately in production without additional equipment. This versatility greatly extends the range of applications of the oven.

Combination timing belt and V-belt that permits the transmission of power with both sides of the belt has been introduced by United States Rubber Co. This type of double-duty belting enables users to take advantage of a positive drive, nonslip timing

Dual Power T-V Belts

belt that requires no lubrication.

The T-V belts, of integral construction, are manufactured in $\frac{3}{8}$ and $\frac{1}{2}$ -in. pitches for light and heavy duty applications. Other pitches will be added to the line and special pitches can be fabricated upon order.

Timing belts can operate at speeds up to 16,000 fpm on fixed centers without take-up adjustments. Flexibility permits pulley diameters as small as $\frac{1}{2}$ in. at 10,000 rpm with relatively heavy loads.

Suppliers Directory

Consult THE TOOL ENGINEER Suppliers Directory to get in touch with local suppliers of tools and tooling.



CUTTING TOOLS

are
"Engineered for You!"

For almost half a century ECLIPSE has engineered and produced quality cutting tools. These years of leadership in the field guarantee the superiority and dependability of all ECLIPSE products. For longer tool life, finer finishes and better all-around performance, look to the symbol of perfection.

- H.S.S. CUTTERS
- BACK SPOTFACERS
- INSERTED BLADE CUTTERS

- T.C.T. CUTTERS
- MULTI-DIAMETER CUTTERS
- PORT CONTOUR CUTTERS

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ECLIPSE COUNTERBORE COMPANY

1600 BONNER AVE., DETROIT 20, MICHIGAN

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interchangeable with all
standard JIC cylinders

With the introduction of the ALL NEW T-J Squair Head, Tomkins-Johnson now offers industry the most complete design range of air and hydraulic cylinders. Presently available in bore diameters from 1-1/4 to 8 inches, the T-J Squair Head is an interchangeable cylinder which produces maximum force and efficiency, with minimum pressures . . . and is also adaptable to the use of low pressure oil as the working medium. Write today to The Tomkins-Johnson Co., Jackson, Michigan, for Bulletin #SQ 10-58 and complete details.

CHECK THESE 10 POINTS OF T-J SUPERIORITY

1. One Piece Piston
2. Hard Chrome Cylinder Bore and Piston Rods
3. High Tensile Steel Tie-Rods
4. Cushion Adjusting Screw, Externally Adjustable
5. New Super-Cushion for air, or Self-Aligning Master Seal for oil (T-J Patents)
6. Solid Steel Heads and Mounting Plates Standard all Models
7. Port Design Allows Minimum Pressure Drop on Inlet or Outlet
8. Chevron Type, Self-Adjusting Rod Packing
9. Piloted Packing Gland—Absolute Alignment
10. Piston Rod, Extra Strong—Polished and Chrome Plated for Efficiency and Protection



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CREATIVE THINKING—By Charles S. Whiting. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Price \$3.95. 175 pages.

Current thinking about creativity in a common sense objective manner is the basis of this study. Various operational techniques in creative thinking that have proved useful in the stimulation of groups to develop ideas are discussed. In addition to describing the various methods, e.g., brainstorming, techniques are evaluated as to their strengths and weaknesses.

THE ROLLING OF STRIP, SHEET AND PLATE—By Eustace C. Larke. Published by the McMillan Co., 65th Ave., New York 11, N. Y. Price \$12.75. 410 pages.

Attempts have been made to apply scientific principles to the design and operation of a rolling mill. When properly applied, these principles increase productive efficiency, decrease risk of mechanical breakdown and enhance the shape and dimensional qualities of the product. The author describes roll cambers, causes and control of gage variation, factors affecting rolling loads, design of rolling equipment for maximum production and calculation of roll separating forces during hot and cold rolling. In addition, the energy consumed and the horsepower developed during hot and cold rolling can be computed by the techniques described in the book. Special chapters describe some modern concepts of modern rolling mills such as Sendzimir and Planetary mills.

. . . O.E.E.C. Reports

Published by the Organization for European Economic Cooperation, Paris, France. Copies may be obtained at O.E.E.C. Publications Office, 1346 Connecticut Ave., N. W., Washington 6, D. C.

INDUSTRIAL STATISTICS, 1900 to 1957—Price

\$2. 174 pages.

This report is intended as a work of reference presenting the principle statistics of industrial production in Western Europe, United States and Canada and shows wherever possible the trend since the turn of the century. It is written in both English and French and covers such diverse things as the statistics related to energy, metals, machinery and chemical production.

MARKET SAMPLING STUDY ON IRON AND STEEL PRODUCTS—Price \$1.25. 116 pages.

Results of a pilot study carried out in Switzerland, undertaken to determine what contribution of market sampling method might make to a market survey for the basic products such as steel are the basis for this report.

FREEDOM OF ENTRY INTO INDUSTRY AND TRADE—Price \$1.25. 76 pages.

The aim of this study is to survey the various aspects of the problems of freedom of entry into the industry and trade and to discuss the relationship between freedom of entry and productivity.

SIMPLIFICATION, STANDARDIZATION, SPECIALIZATION—Price \$1.25. 117 pages.

This report is a summary of case studies of variety reductions in five companies of the United Kingdom, established by the British Institute of Management. Part one is based on a plant level and Part two is related to the industry level. It includes case studies of variety reduction through or with close cooperation of the National Standards Organization.

COMPANY PLANNING AND PRODUCTION CONTROL—Price \$1. 92 pages.

Basic principles of company planning and control are essentially simple and this report is intended to be a statement of principles and show how they are applied. A case of a typical manufacturing company has been chosen because the problems are common to many other businesses.

RESALE PRICE MAINTENANCE—Price \$1.50. 114 pages.

The aim of this report, which is one of the studies on problems connected with restrictive business practices, is to summarize existing knowledge and opinions regarding the practice of resale price maintenance in member countries and assess the effects of these practices on productivity.

GLOSSARY OF WORK STUDY TERMS—Price \$1.50. 124 pages.

This is a glossary of work study terms in English, French and German in a form that gives the equivalent terms without definitions. Descriptions are given when the equivalent terms are

lacking in other languages.

SOME ASPECTS OF CONSULTANT ENGINEERING IN THE UNITED STATES—Price \$1.25. 116 pages.

This report, written by experts from seven European countries, investigates and details such aspects of American consulting practice as organization, legal matters, services rendered, staffing, types of work executed, types of contract fees, relations with manufacturers and government agencies that may be adapted to European conditions.

THE IRON AND STEEL INDUSTRY IN EUROPE—Price \$1.50. 146 pages.

This report published and prepared by the Iron and Steel Committee, contains specific information relative to the supply and demand, production, investments, international trade and price

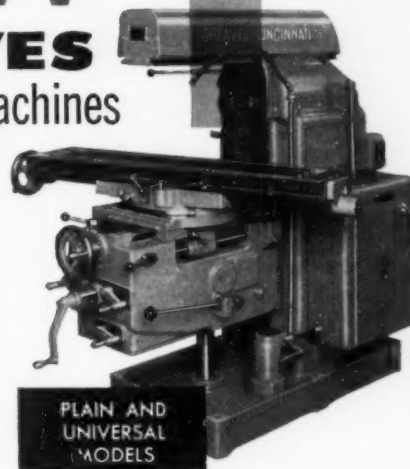
trends of the European iron and steel industry. In addition, statistical information is included on availability and production breakdowns of iron and steel products and byproducts.

ENGINEERING INDUSTRIES IN EUROPE AND STATISTICAL SUPPLEMENT FOR 1957—Price \$2. 297 pages.

The characteristics of engineering industries in Europe as well as the position of the engineering industries and the economy of the member countries are studied. Trends of output of engineering products, employment, imports, products from nonmember countries and other aspects of the industries are important parts of this report. The engineering industries include manufacturing industries producing goods in the fields of metals, machinery, transport equipment, scientific items and other similar products.

new GREAVES 2-XH Milling Machines

more
power at
the cutter!



The completely new GREAVES No. 2-XH Milling Machine brings added versatility, increased operational ease, and more power where it's needed most . . . at the cutter!

It utilizes two motors, one for spindle drive; a separate motor for moving table, saddle and knee. Compare this and the other outstanding features of the new Greaves Mill. You'll see why Greaves is "The MOST Mill for the LEAST Money."

Write for detailed literature!

GREAVES

MACHINE TOOL SYSTEMS

J. A. FAY & EGAN COMPANY

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- Wide range of speed/feed combinations for any type material, any type job.
- Heavy, internally ribbed column casting and heavy duty rectangular overarm for maximum rigidity.
- Large, heavy-duty knee, saddle and table provide accuracy for all types of milling.
- New 7 1/2 HP spindle drive motor, with separate motor for movable components, provides extra power for heavy milling.
- Easy-to-reach controls. Handwheels and vertical crank disengage automatically when not in use.
- New rapid traverse lever within operating control area.
- Separate drive motor for table, saddle and knee provides more smooth balanced power at the cutter.

ARE YOU READY WITH THE ANSWERS

Threadwell
MAKES THE BEST
PRODUCT BETTER



Threadwell Field Men and
Distributors Can Help You
in Production Planning

When your next order involves multiple or complicated machining operations, and you've got your processing and production equipment all lined up, make sure you insure your investment by putting Threadwell cutting tools in those holders. They'll provide the uninterrupted high quality production all your machine tools are designed for.

Before pushing those buttons, check with your Threadwell Distributor. His experience and advice costs you nothing



THREADWELL TAP & DIE CO.
GREENFIELD, MASSACHUSETTS

Stocking Warehouses: New York — Cleveland
Detroit — Los Angeles — Greenfield, Mass.

Men at Work

CARLISLE M. THACKER, formerly an engineering consultant with E. I. DuPont de Nemours, has joined Taylor Fibre Co., of Norristown, Pa. as technical director. Dr. Thacker will be in charge of all research, product development and quality control activities for the firm, a leading producer of laminated plastics and vulcanized fibre.



John Moxon, left, has been elected president, and **Frank R. Palmer**, right, chairman of the board of the Carpenter Steel Co. Both men assumed their new posts on July 1. Formerly executive vice president, Moxon will assume responsibilities as chief executive officer. Palmer, president since 1948, fills a vacancy created by the death of J. Heber Parker.



W. R. Gerchow, executive vice president of Buhr Machine Tool Co. of Ann Arbor, Mich., announced the promotion of **CHESTER S. JOHNS** to the position of general sales manager. An expert in the field of automation, Johns will assume all of the duties formerly handled by A. A. Vetter, who recently left the company.

KENNETH E. LEWIS has been appointed division quality and process control manager for the Stainless and Strip Div. of Jones & Laughlin Steel Corp. He had been connected with Rotary Electric Steel Co. since 1938 in various positions from metallographer to manager of quality and process control for the division's Detroit and Louisville plants.

The appointment of **ERNEST QUASTLER** as plant manager has been announced by Richard E. Kregel, general manager of Ex-Cello-O Corp. of Canada, Ltd. Mr. Quastler joined Ex-Cell-O in 1953 with education and experience in tooling and production methods as well as production supervision.

LEON W. MCGINNIS has joined Conap, Inc., as a project engineer. He has been active in the high pressure laminated plastics field for eighteen years. Prior to joining Conap, Inc., Mr. McGinnis was associated with National Vulcanized Fibre Co. in development.

DR. C. H. TOENSING has joined the Powder Metallurgical Research staff of Firth Sterling Inc. of Pittsburgh. He has been active in preliminary laboratory development work on sintering tungsten, molybdenum, tantalum and their alloys.

CHARLES E. DEMARS has been appointed plant engineer for Tranter Manufacturing, Inc., of Lansing, Mich. In his new position he will be responsible for tooling, equipment and layout.

The appointment of **RAY C. SMITH** as vice president in charge of sales has been announced by George W. Frick, president of Frick Steel Co. Mr. Smith, a member of the ASTE Dayton chapter, had been associated with Latrobe Steel Co. for seventeen years prior to joining Frick Steel.

JOHN D. WILLIAMS, president of Lipe-Rollway Corp. and Rollway Bearing Co., Syracuse, N. Y., has been honored by the Syracuse Rotary Club for his leadership in developing the Syracuse Practical Political plan. He will receive the Club's coveted "Citizen of the Year" award for his activities as president of the Manufacturers Association of Syracuse, in launching the plan which stresses the need for greater political awareness and participation by all levels of industrial management.

The board of directors of The Lincoln Electric Co., Cleveland, Ohio, has elected the following vice presidents: **ROBERT A. WILSON**, **GEORGE F. WILLIS** and **EDWIN M. MILLER**. In addition, **GEORGE F. CLIPSHAM** was elected secretary of the company.

D. E. PEDERSON, tooling manager at Rohr Aircraft Corp., has been promoted to manufacturing manager at the Chula Vista plant. In this capacity, he will direct factory production, tool manufacturing, tool engineering, industrial engineering, maintenance and plant engineering. **J. T. BUTLER**, formerly tool engineering manager, has been appointed to fill Pederson's former assignment as tooling manager.

James L. Daniell, president of Green River Steel Corp. named **NELSON C. WALKER** executive assistant to the president. Walker is widely known in the production and production engineering fields.

J. J. DALL has been appointed assistant general manager, electric welding, Linde Co., Div. of Union Carbide Corp. His responsibilities will include all phases of Heliarc, Sigma, Unionmelt and Unionarc welding processes.



Harnischfeger Corp. of Milwaukee, Wis., announced the creation of a new engineering department post, manager, Crane and Hoist Mechanical Engineering, for their Industrial Div. Named to fill the new position is **Herman L. Koegel**, left, former chief engineer, Crane and Hoist Development. **Douglas E. Holt**, right, senior design engineer, succeeds Koegel.





ASM presented the society's 25-year certificate award to A. E. Holden, left, president of the A. F. Holden Co., Detroit manufacturer of heat treat furnaces.

Kimball C. Cummings, right, has been appointed manager of engineering of Minneapolis-Honeywell's Beltsville, Md. division.



Major organizational changes in research and development at Carborundum Co. have resulted in the promotion

of DONALD G. STURGES, formerly manager of the New Products branch to associate director of Research and De-

velopment Div. In addition FREDERICK J. ROSS, JR., formerly manager of the Ceramic Fiber Project was promoted to manager of the New Products Development Branch to succeed Sturges. DR. WINGATE A. LAMBETSON was promoted from assistant manager to the position of assistant manager of the Engineering Research Branch.

Carpenter Steel Co., of Reading, Pa., announced the promotion of NORMAN D. GROVES and NEIL J. CULP to the posts of assistant managers of research. Groves will be in charge of the chemistry and physics projects, while Culp will be assistant manager of research in charge of metallurgy.

JOHN S. KLINE has been appointed general manager and chief executive of Carpenter Steel Co.'s Alloy Tube Div. of Union, N. J., to succeed P. L. Codrington.

M. CARL HADDON has been appointed a vice president and general manager of the new Electronics and Avionics Div. of Lockheed Aircraft.

A new management team has been announced by Michigan Oven Co. of Detroit, with the appointment of A. O. TOWNE as chairman of the board and L. M. GILL as president. New vice president C. A. WINDSOR was formerly in charge of the Wire and Wire Products Dept., and secretary-treasurer, B. C. Smith was promoted from secretary and chief design engineer.

Appointment of S. J. BECKER as vice president and chief engineer of the Spring Div., of Borg-Warner Corp., was announced today by Harry P. Troendly, President of the division.

Several promotions of veteran employees of Diamond Alkali Co.'s, Chromium Chemicals Div. to key positions within the division were announced by F. W. Jarvis, general manager. A. W. WALLER, manager of the division's Kearny, New Jersey plant, becomes operations manager of the division at both Kearny and Painesville. GEORGE HENDERSON, assistant plant manager at Kearny succeeds Waller and becomes general superintendent at Kearny. GEORGE BARBIERI, special staff assistant at the company's Cleveland headquarters office, becomes general superintendent of the division's plant at Painesville. MATTHEW A. KILLINEN, assistant superintendent at the Painesville plant will be assistant general superintendent at Painesville.

SMART TOOLING

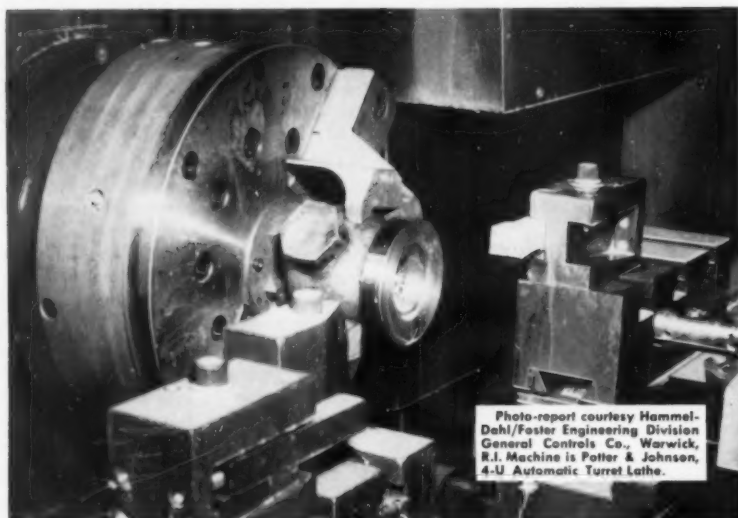


Photo-report courtesy Hammel-Dahl/Faster Engineering Division General Controls Co., Warwick, R.I. Machine is Potter & Johnson, 4-U Automatic Turret Lathe.

Jumps production 8 to 40 pieces per day with *Buck* 15" Aluminum power chuck

The round valve body was hard to hold on a turret lathe with a 4-jaw chuck—and truing each piece took too much time and labor. Production was 1 piece per hour, only 8 a day.

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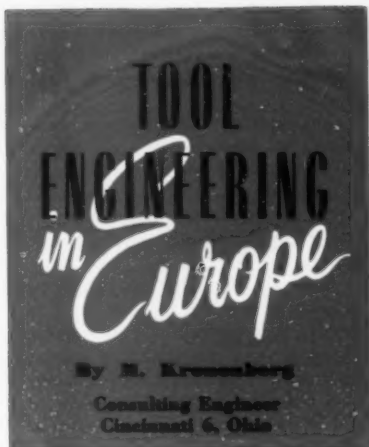
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Synthetic Diamonds

G. Pahlitzsch recently investigated the application of synthetic diamonds to the grinding of carbide tools and reports on it in an article published in *Werkstattstechnik*, Vol. 49 (5), 1959, p. 241-247 under the title: "Einsatz Synthetischer Diamanten beim Schleifen von Hartmetall."

Grinding wheels impregnated with synthetic diamonds were found to be superior to those with natural diamonds when grinding carbide tools. This refers particularly to the quantity of abraded metal, although the efficiency depends on the properties of the bond and on the method of truing.

Better performance of synthetic diamonds is due to the sharper contours of the diamond particles. A tool surface finished with a synthetic diamond wheel is slightly rougher than one finished with a natural diamond wheel. The difference, however, decreases with the use of the wheels. Properties of the synthetic diamonds produced by General Electric Co. are discussed and it is claimed that the synthetic diamond wheels permit a reduction in grinding cost, although the price of comparable wheels is the same. Contours of the diamond grits were determined by means of an electron microscope permitting a 12,000X magnification.

High-Speed Steel Microstructure

It is often believed that inspecting an etched specimen of heat-treated high-speed steel permits one to readily recognize whether the piece under investigation has been annealed sufficiently. E. Kunze has found that the martensite structure which covers the fine grain network represents only a special case. He reports his findings in *Stahl und Eisen*, Vol. 74 (3), 1959, p.

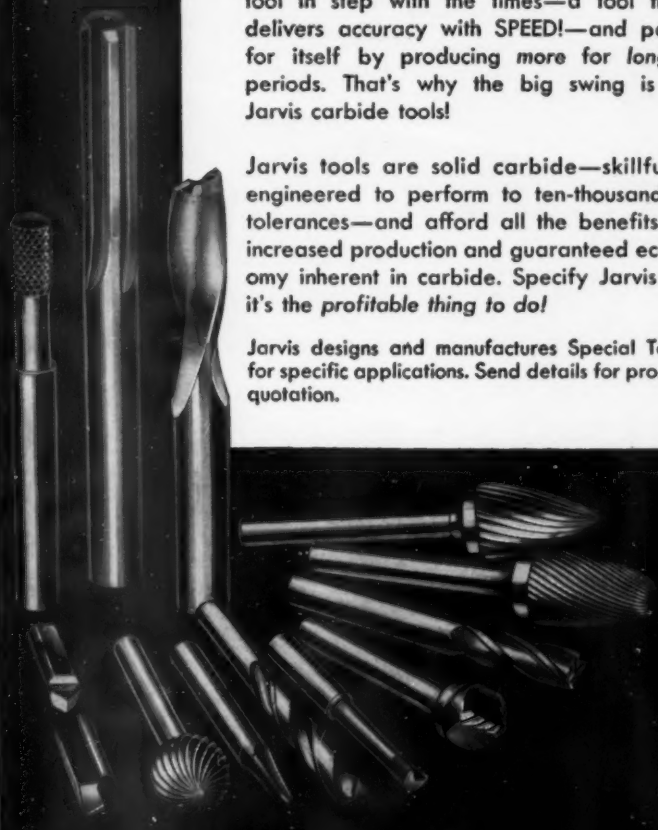
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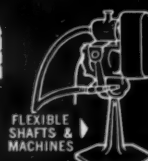
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145-148. Title of his article is "Zur Beurteilung des Gefuegebildes von gehärtetem und angelassenem Schnellstahl."

The special microstructure appears only after a single annealing operation at conventional annealing temperature. It depends on a number of variables such as chemical composition of the steel, heat treatment, technique of etching and so on.

Since the vanishing of grain boundaries is due to the breakdown of martensite, it is possible to draw some conclusions as to the preceding annealing operation. The author shows, however, that visibility of grain boundaries must not be taken as proof of a surplus of austenite and thus of insufficient annealing treatment.

Grinding Carbide Tools

Effects of grinding speed and the influence of the size of the grinding surface have been investigated by G. Pahlitzsch and G. Raffenbeul. Results are described by them in an article published in *Werkstatt und Betrieb*, Vol. 92 (4), 1959, under the title "Schleifen von Hartmetall bzw. Hartmetall-Schneiden mit Diamant Schleifscheiben."

It was found that an increase in grinding speed with bronze and resin-bonded wheels caused an increase in the wear or abrasion of the sintered carbide tool and likewise an increase in the wear of the wheel. This holds true when the grinding time is held constant. In the case of bronze-bonded wheels, when speed is varied and the contact zone is kept constant, abrasion increases, although grinding time is reduced. A slight increase in the specific grinding wheel wear results.

With resin-bonded grinding wheels, the abrasion is lower at higher speed because of the reduced grinding time and the absolute and specific grinding wheel wear increases.

When the grinding surface is increased in area, abrasion with a bronze-bonded wheel is greater if the surface pressure is constant. The grinding wheel wear tends to decrease with increasing thickness of the carbide tip as long as the pressure stays within a certain limit. In order to keep abrasion constant with increasing thickness of the carbide, the pressure must rise according to a parabola.

When resin-bonded wheels are used, the abrasion and grinding wheel wear drop with rising roughness of the grinding wheel. Specific wear (or unit wear) is at its maximum when the surface is of medium roughness. This occurs when grinding with a constant surface pressure and constant force.

Milling Forces

Unit cutting forces in peripheral milling follow different values than in turning, according to an investigation by H. Phillip, published in *Werkstatt und Betrieb*, Vol. 92 (4), 1959, p. 179 ff. The title of the article is: "Ueber Messungen der spezifischen Schnittkrafte beim Walzenfräsen."

Although a few quotations seem to contain typographical errors, the article is of interest and states that no substantial difference exists between "up" and "down" milling forces. Chip thickness was found to be a dominant factor, rather than the geometrical shape of the chip.

Metal Forming

A report on a number of papers is given in *T. Z. für praktische Metallbearbeitung* May, issue No. 2, Vol. 53, 1959. This issue covers metal-forming processes and machine tools. These papers were presented at the sixth colloquium of Technical Universities on metal forming held at Hannover, West Germany.

Dr. Stier discussed work psychology and its relation to the design of small presses, covering such topics as height of the table, position of the tool, time study and design, and so on. Dr. Feldman presented theoretical formulas for extrusion presses, including the deformation rate in relation to the ram speed for forward and backward extrusion of hollow bodies.

An article by Lane surveys the development of extrusion presses. Hoertig discusses a rolling mill for production of turbine buckets. The tolerances that can be obtained on these machines are about ± 0.000080 inch depending on the rolling tools used. The buckets can have a helix up to 45 deg.

It is claimed that considerable savings are possible due to reduction in manufacturing time, reduction in waste and improved surface finish, and that greater freedom is made possible in the selection of bucket materials due to the rolling process. The rolling time is about one to two minutes per bucket.

Other articles deal with application of swaging machines (Gabriel), tests on chain-operated drop hammers (Jarausch), and planned maintenance of forming machines (Peddinghaus).

Suppliers Directory

The Suppliers Directory included in the June 15 issue of THE TOOL ENGINEER makes it possible to quickly get in touch with the local representatives of all manufacturers of machines, tools, tooling and supplies.

ALLEN

The cost of ALLEN Hex-Socket Cap Screws is only a minor fraction of your assembly costs . . . be sure you're getting the timesaving, cost-saving advantages of genuine Allens!

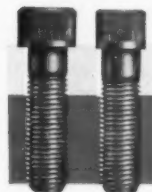
Ever since Allen first produced the hex socket head screw nearly fifty years ago, specifying *genuine Allens* (made by Allen of Hartford) has been a sure way to guarantee dependable threaded fastening.

Only *genuine Allens* have Leader Points that make starting easier, and greatly minimize danger of cross threading. *Genuine Allens* are "pressur-formd" to preserve the long fibers uncut throughout the length of the screw, giving stronger sockets for greater tightening torque.

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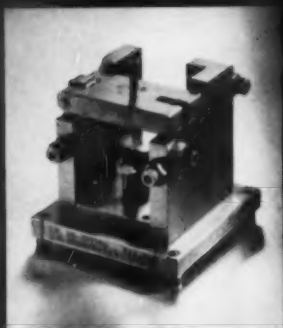
Head diameter of sizes from $\frac{1}{4}$ " up is now uniformly $1\frac{1}{2}$ times the body diameter—providing more under-the-head bearing surface, and a proportionate increase in clamping force. Write for new Bulletin G-25, with full specifications.

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.....readers' viewpoints

... suppliers' directory

To the Editor:

We would like to compliment you on the June 15th issue. This Suppliers' Directory issue will be of great value to industry across the U. S. A. and Canada. Companies such as ourselves will find it of great help, but even more important, those responsible for purchasing and selection of equipment and cutting tools in industrial plants will also, I am sure, make considerable use of it. Therefore, it will be to our advantage as a supplier.

L. B. Manning
Vice Pres.

A. C. Wickman Limited
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... heart surgery

To the Editor:

It was with considerable interest that I absorbed the contents of the report in the May issue of THE TOOL ENGINEER on the medical engineering forum held at Ann Arbor, Michigan.

The pooling of medical skill and engineering talent for the purpose of advancing surgical techniques has been pursued effectively, on a full-time basis, here at Baylor University College of Medicine for the better part of one year. My appointment by Dr. Michael E. DeBakey, Chairman of the Department of Surgery, in August 1958, as Research Associate in charge of design and development of surgical instruments and apparatus, created the atmosphere vital to successful, productive cooperation between surgeon and engineer.

Blood pumps, oxygenators, mechanical aspirators, syringe drives, noncrushing artery clamps, bone stapling devices, roto-rooter type artery reamers and numerous other surgical instruments, many of which are entirely new and as yet untried, are providing a full measure of challenging projects in design, modification, improvement, evaluation, testing and manufacturing. A modern, completely equipped machine shop adjacent to my office enables me to have pilot models produced.

The joint venture launched at Ann Arbor will not fail to affect most productively the future course of medical research and techniques. Please convey to Mr. Leon DeVos and all mem-

bers of the ASTE chapters concerned my sincerest wishes for success in solving the many problems awaiting them.

*Walter T. Mendelson
Research Associate
Baylor University
College of Medicine
Texas Medical Center
Houston, Texas*

...surface plate specifications

To the Editor:

In my previous Readers' Viewpoint letter, I suggested use of two surface plate accuracy specifications: (1) a technical specification, (2) a performance test. The 1 out of 100 surface plate users with optical checking equipment can use the technical specification; the remaining 99 can use the repeat measurement performance test.

Mr. Porter has most generously offered the service of his inspectors with their autocollimators to check all surface plates for all users who do not have this instrument. Being realistic, I am sure he realizes that he could not perform this service on more than 1 percent of the 100,000 surface plates in use. This leaves 98 out of 100 who must have some way of determining whether their surface plates are satisfactory.

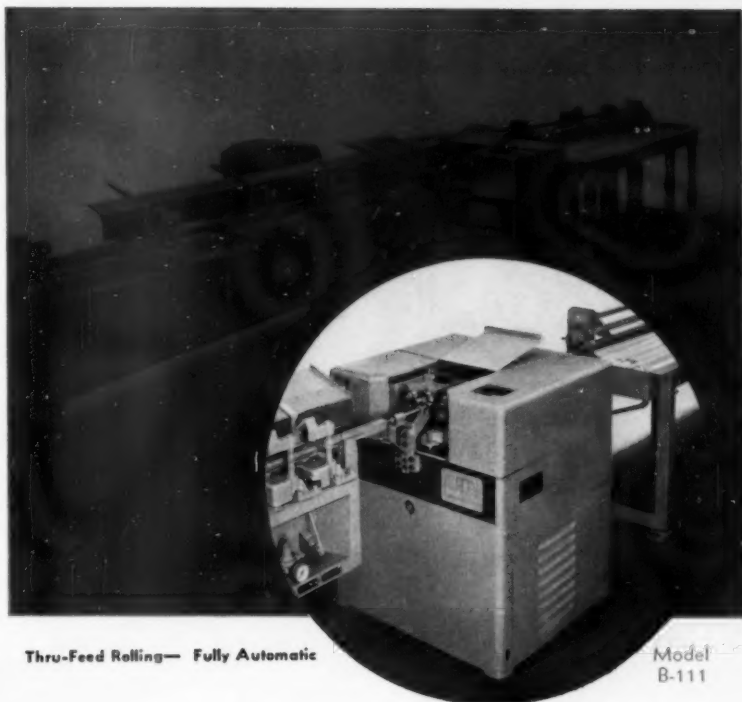
We believe the only reason for checking a surface plate is to be sure that correct measurements can be taken on it. One way to do this is to see if it conforms to a properly written technical specification. We endorse the Canadian specification, as far as it goes. It is now in print as 39-GP-31.

The 98 out of 100 surface plate purchasers may wish to write a technical specification on their purchase orders, but should also write the repeat measurement performance test. Without the necessary instruments, they will not be able to check the technical specification, but they can make the performance test.

Mr. Porter refers to the surface of a ball and states that repeat measurements do not guarantee flatness of a surface plate. His theory is correct for the small ball that he is considering. However, a consistent segment of a ball of extremely large diameter involves additional principles. These principles make consistently accurate measurements possible. I doubt whether the readers are interested in the theoretical discussion, "When does a small ball become a large ball?" May I suggest that each ask this question, "If measurements on a surface plate cannot be repeated, can the surface be accurate?"

R. J. Rahn

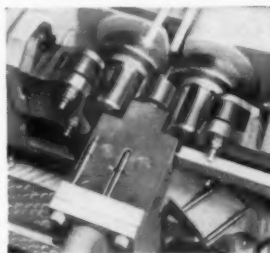
*Rahn Granite Surface Plate Co.
Dayton 7, Ohio*



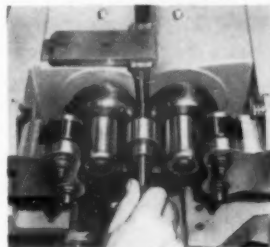
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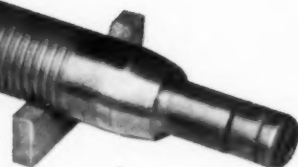
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An entirely new concept in broaching precision gears and splines for automotive and aircraft industries has significantly reduced production costs and at the same time materially improved gear quality. Both roughing and finishing are completed in a single pass of the tool.

Broached tooth surfaces are not only true to form but are entirely free of the generating tool marks which are unavoidable with conventional broaching tools. Surface smoothness checks out between 5 and 8 microinches in the direction of broach travel.

The secret lies in the ingenious design of this new Red Ring broach (patents pending). The roughing section generates gear teeth in the conventional manner. Following the roughing teeth is an interchangeable shell-type section having 12 rows of finishing teeth. Each row cuts about 0.00025" of stock on the full profile of each side of the gear teeth—hence the remarkable tooth surface smoothness attained.

Using this method on a 3.5" PD, 35 tooth internal running gear, a prominent transmission builder found broach life of the roughing section to be 50,000 work pieces—that of the finishing section, 150,000 pieces.

Write for specific data regarding the application of Full-Form Finishing to your operations.



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Operations Planning

By E. W. Cummings

Supervisor, Plant Eng. & Methods
Saginaw Steering Gear Div.
General Motors Corp.
Saginaw, Mich.

GOOD PRINCIPLES of planning are a major step in minimizing cost. Some details are often overlooked in the manufacturing planning of a new product at the most economical cost. These same principles are also applicable to model changes and manufacturing process revisions.

Normally, a release from product engineering is the first step toward informing tool engineering that they are to plan a manufacturing operation. However, all engineers from the manufacturing group at Saginaw Steering Gear are encouraged to keep such close contact with the product engineers that they are not surprised when the release is made. In fact, the manufacturing engineers already are familiar with the results of durability tests, function tests, and other laboratory and proving ground tests. They know the customers' functional requirements and they are aware of the pending changes and new designs. In certain instances, as in the design of the current rotary valve power steering, a key manufacturing engineer was temporarily assigned to product engineering to put those features into the design which aid manufacturing. In this manner, the questioning attitude is utilized and the extreme importance of releasing designs that can be economically manufactured is further impressed upon the designing engineers. This condition is dependent on a product engineering policy that accepts constructive suggestions. That policy demands that the product engineer design for low cost as well as function.

The close working relationship of product and manufacturing engineers is a major step in planning a product that is engineered for manufacturing as well as function. Some dramatic savings are possible by cold forming a part instead of removing metal by conventional machinery. An instance of this is in the production of propeller shaft

spider bearings. Twelve are used on most automobiles. The quantity of chips made on each bearing is shown in Fig. 1. This, plus the cutoff material, saved 1180 tons of steel and some added labor. These combined efforts of engineering can, and should, also evaluate the economics and functional desirabilities of using raw materials which have been preprocessed by any one of the many metal-forming operations, such as: (1) forging, (2) extrusions, (3) sand casting, (4) shell casting, (5) die casting, (6) powdered metallurgy, (7) any others.

They can also specify paints that lend themselves not only to automatic painting but to "lectron" gun painting. An example of this is the automatic "lectron" gun painting of power steering pumps, Fig. 2, where the amount of paint used was reduced from 65 cc to 17 cc per pump. This saved 7640 gallons of paint each year. Further use of this combined approach is used at Saginaw Steering Gear when the tool engineer is given authorization to purchase machines and tools.

Now, many a tool engineer is concerned solely with two things: making

a part to print, and making enough parts. Many a methods engineer concerns himself solely with applying the principles of good methods engineering to all of the tooling and machinery that is to be used. However, by working together and with liberal use of the questioning attitude, they can go further than they could separately. They can plan the most economical method of manufacture.

Look at it this way: One would say we pay a man eight hours to operate a drill that machines 3000 pieces. But what does the man really do in his eight hours? He loads 3000 pieces, he hits the clamp lever 3000 times, he picks the start button 3000 times, he hits the unclamp lever 3000 times, he unloads 3000 pieces, he picks up an air hose and blows off the fixture 3000 times, etc. This is what we pay the operator to do, isn't it?

Now we can proceed to decide which of these manual elements of time can be done economically by mechanization. The methods engineer can determine the time saved, the tool engineer, the added equipment cost. Maybe the unclamping and the blowoff should be

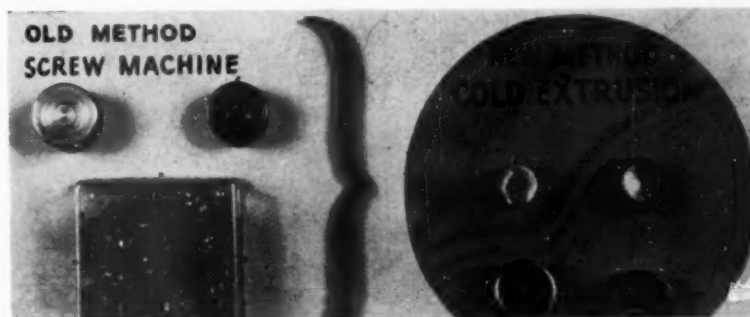


Fig. 1. Comparison of production methods for the manufacture of propeller shaft spider bearings. This

change in methods made possible a savings of material and a stronger part as well as reducing handling costs.

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Within a matter of 2 hours this holding fixture was poured and ready for use at General Electric, and the cost — about \$20.00 instead of the original \$200.00. Whether you need jigs, fixtures, metal forming dies, molds, models, foundry patterns and core boxes or other special tools, PLASTIC STEEL® and other Devcon products will produce a precision form and save hundreds of dollars and hours.

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tech digests

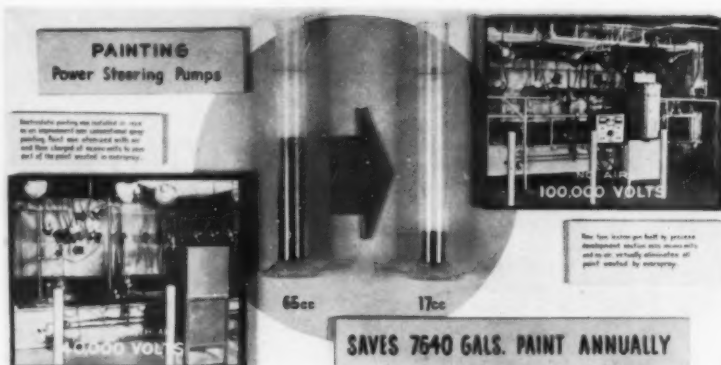


Fig. 2. Improved painting methods resulted in a substantial saving in paint. This application of a new meth-

od to an old process results from co-operation between tool engineering and production.

done without labor. Probably automatic loading would not justify itself, but it should be evaluated. Fig. 3 shows an old operation on a steering linkage forging before we combined the engineers.

The hourly production required was 350 and the tool engineer was satisfied that the quality would be satisfactory if the job was done on this Natco netting 400 per hour. The tool engineer accomplished his two goals of sufficient production and sufficient quality. At this point, the methods engineer could have pointed out that the machine should have been made for four pieces per station instead of three. Then the operator's motions would be balanced, production increased. It should have automatic unclamping, unloading and starting. It would have cost \$4000 more and saved

\$8000 per year.

We like our people to remember that a second saved on any single operation on our power steering, where the volume is one million units per year, is equal to saving one million seconds per year. This amounts to \$905 annually for just this one second on one operation. There are many examples of overlooked details which add to cost by adding elements of manual work. commonplace are those fixtures which are not designed with bell-mouthed or bullet-nosed locators, or designed free from other movement-slowing barriers.

One of the most serious details overlooked, in planning a job for production, is a place for chips to go from the time they are first generated. Who hasn't seen a mess where chips contribute to

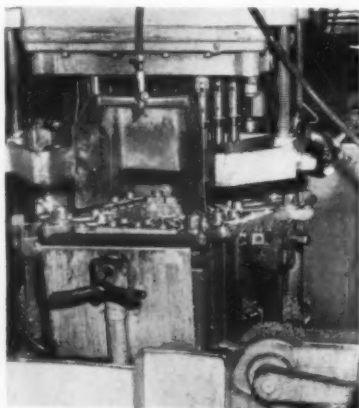


Fig. 3. Drilling operation before improvement by combined efforts of methods and tool engineers.



Fig. 4. Cleaning chips out of the bed of a machine on a turning operation to prevent malfunction.

tech digests

blocking stops, nonfunction of limit switches, and excessive maintenance, Fig. 4. These all increase costs.

Planning operations at Saginaw Steering Gear start with the tool engineer being in a position to aid the product engineer even to the point of temporarily becoming a product engineer. As planning progresses, the methods engineer is in a position to aid the tool engineer in the purchase of equipment. The intent has been to point out some of the details often overlooked in planning the low-cost manufacture of new products. A concerted effort to pay attention to these details will go a long way toward keeping down the price of products.

Based on a paper presented at the National Production Meeting of the Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

TO REQUEST COMPLETE PAPERS
WRITE TO THE ADDRESS AND
ORGANIZATION INDICATED AT
THE END OF EACH ABSTRACT

Cutting Tools and Foreign Trade

By H. G. Bixby
President
Ex-Cell-O Corp.
Detroit, Mich.

When I propose that this country discard its protectionist principles and work instead toward the elimination or reduction of tariffs and other trade barriers, I realize that this is still considered in some circles as the rankest form of economic blasphemy. Of course, as we reduce our barriers to imports, we must see that foreign nations reciprocate in reducing their trade barriers against our exports. Foreign trade is a two-way street.

But somehow the world has a habit of changing, and we can neither change with it or disassociate ourselves from the rest of the human race.

It is imperative for American business to start realizing that nationalism is spreading like a brush fire throughout the world. Nations are striving for self reliance and for an independence that is not only political but economic as well.

Americans have the false impression that the rest of the world cannot get along without them. There is far too much complacency in this country . . . The biggest, the bestest, the mostest. Believe me when I say that we don't

have more than ten years in which to get over this complacency.

It has become characteristic in this country to demand more and more for less and less—more leisure, more money and less work.

Too long have we said that European machine tools are no good. Such a remark had some basis in fact until five years ago, but it no longer holds water.

The American people must get down to some sound thinking. We must tighten our belts. We must act on inflation. Standing grimly in the forefront is the simple economic fact that when the products of two companies are nearly equal, the customer usually will buy the cheaper one. Continued unchecked inflation keeps us from competing, yet we still hear prolonged and impassioned demands for more and more in return

for less and less. Consider that the cost of living in the last ten years has risen 20 percent; our federal budget has increased 100 percent; federal tax receipts are up 91 percent and employee compensation per man-hour in manufacturing has risen 59 percent—without fringe benefit—and with fringe benefits—approximately 80 percent. All this provides the backdrop for the main performer in this drama of inflation—the output per man-hour in manufacturing. That output has increased only 43 percent. We must bear in mind that machine tools and many cutting tools are custom built and as a result do not share in the increase per man-hour like many mass produced products that lend themselves to highly automated processing. The wage price push in this country is rendering our machine tool

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and cutting tool industries more and more noncompetitive in the world markets and bringing about more and more imports from abroad. There must be a keener sense of responsibility from organized labor, an equating of wage costs in terms of productivity.

Here in Detroit, the capital of the automobile industry, we are witnessing a revolution in machining and design. Automobile forgings continue to be replaced by stampings. An increase in chipless machining can be forecast. Because of the auto industry's trend toward aluminum engines, the multiplicity of machining operations will be reduced. Greater use of aluminum over iron will mean that cutting tools will

have a life span of three to four times longer. This means, of course, that the market for cutting and machine tools will not be as great as in the past. What we will see as a result, is a change in the types of machine and cutting tools. Certain present types will become obsolete, while other new types requiring more precision and higher speeds and feeds for aluminum will be required. Thus, overall, there should be no reduction in the total value of machines or machine tooling.

The machine tool which gives the highest output at the lowest cost will be the machine tool in greatest demand. Coming to the fore are many new processes and products . . . chipless shaping, rolling of splines and gears, fluting, precision casting, sintered casting, electric discharge and electrochemical machining and numerically

controlled machines. New products will emerge from the new processes and materials constantly coming from man's research and ingenuity. Automation will seek and conquer new horizons. So, from technology, we can expect many exciting developments.

The future for machine tool exports appears rather bleak. A partial solution has been the establishment by a few American manufacturers of foreign subsidiaries. This is not an easy measure to undertake. Adjustment of some magnitude must be made to conform to the overseas scene. Personnel and management problems are often difficult to cope with. There is the constant need to conform to the national philosophy where you find yourself.

It must be remembered that, as recently as ten years ago, 80 percent of the machine tool builders in this country were family owned firms with fewer than 500 employees. Smaller companies, in this age of bigness and merger, are hard put to survive. For them there is no planting of an extra root on foreign soil, because they have neither the shovels nor the money. I don't wish to sound as if I'm preaching a death sermon, for I believe these companies, small though they are, will continue to exist . . . some will even thrive. But it won't be easy. Many of them can insure a continuation of their product in the foreign field by licensing arrangements.

Based on a paper presented before the Cutting Tool Manufacturers' Association, Penobscot Bldg., Detroit 26, Mich.



Improving Communications

By Dr. Sanford R. Berman

University of Chicago
Chicago, Ill.

If I were to give you suggestions on improving your communication it would include the following:

1. Pause and delay before speaking or while listening.
2. Don't jump to conclusions. Know the difference between your inferences and statements of fact.
3. Don't close your mind or act as if you have more knowledge than you really have.
4. Use specific and concrete words in speaking and writing.
5. Remember that we learn the "meanings of words" from our past experiences—and his might be different than yours.
6. Concentrate on the meanings in the person, not in the word. Words don't mean, people mean!
7. Words are ambiguous and can be used in many different ways or senses.
8. Be a good listener. Don't be afraid

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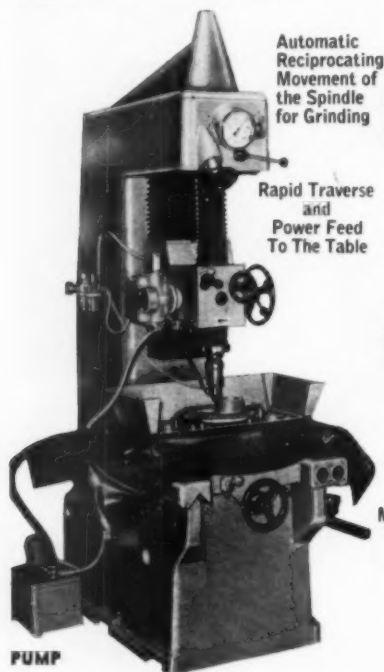
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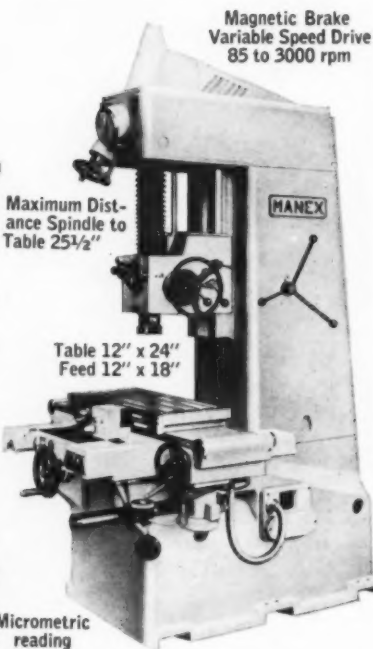


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to ask, "What do you mean" if you don't understand.

9. Be conscious of projecting wrongly your meaning into other people's words.
10. Semantic wisdom begins at home. Keep working on yourself to improve your communicating, for it is far too easy to see the communication failures in others and to forget about yourself.

Based on a paper presented at the National Safety Congress of the National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

TO REQUEST COMPLETE PAPERS
WRITE TO THE ADDRESS AND
ORGANIZATION INDICATED AT
THE END OF EACH ABSTRACT

Teamwork in Personnel and Public Relations

By Dwight J. Thomson

Vice President
Personnel & Public Relations
The Champion Paper & Fibre Co.
Hamilton, Ohio

"What are we learning from all our personnel and public relations activities?" First is the necessity for determining objectives—learning what the needs of the organization may be, trying to formulate ways and means of meeting those needs—in other words, first deciding what we are trying to do.

Next is to get all the help we can in doing our job. Call it participation, or whatever you may prefer, but it is a determined effort to identify, analyze, and solve our problems by working with and through all employees, not just the management people, who may be concerned.

Third is a constant evaluation of the results of everything we are trying to do. In this area we have a great deal more to learn than we now know in terms of techniques, methods of appraisal, and the reliability of the results.

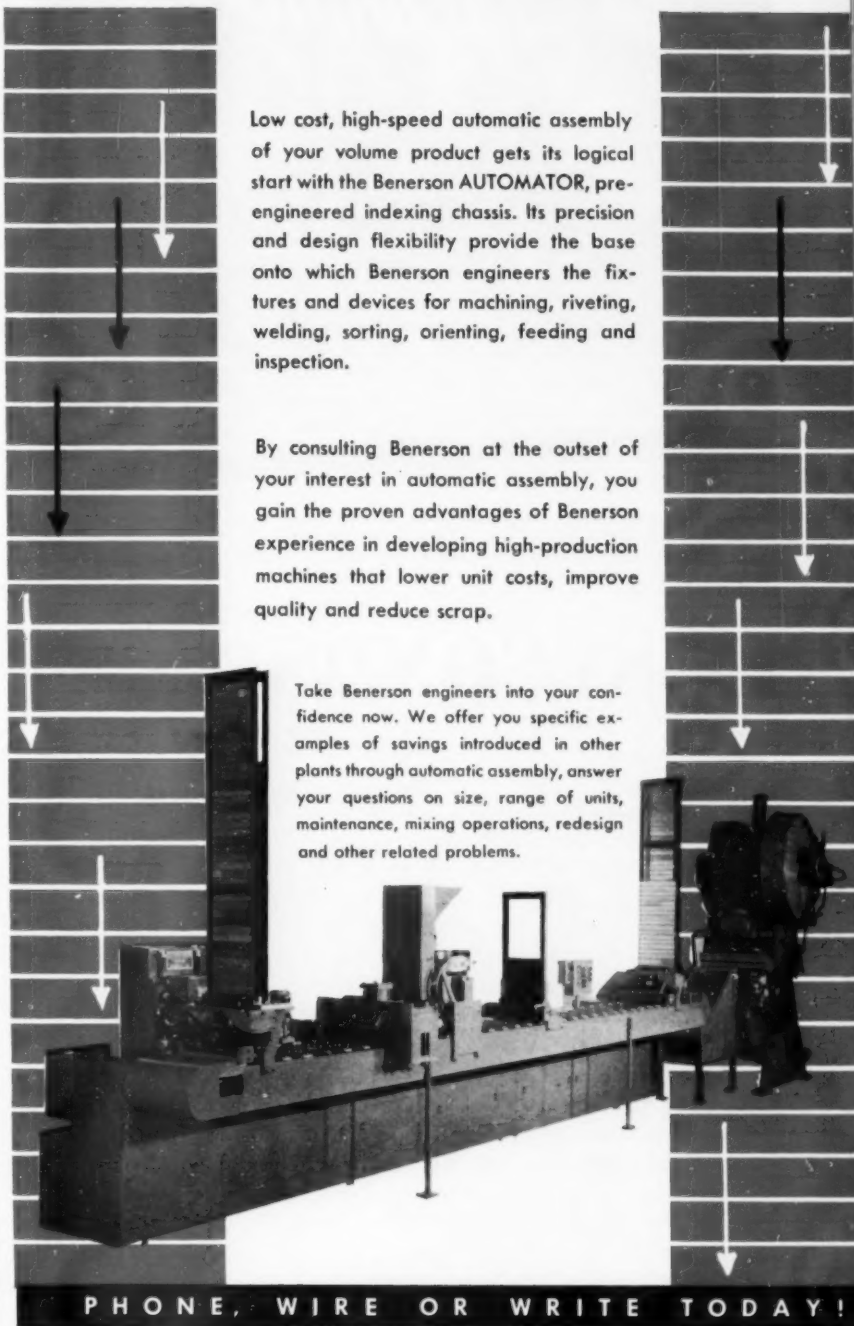
In the framework of our concepts, the personnel and public relations staff must work together as a cohesive group to utilize the talents and abilities of everyone in the manner that is most effective. Moreover, we can't work with shareholders, employees, customers, neighbors, and suppliers without realizing that often one individual may be a member of more than one of these categories. The interests of all are interrelated and interdependent. Working

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together we can assure that the organization through which each group can fulfill its particular needs and desires will continue.

We feel the primary responsibility of personnel and public relations is to create a climate in which our people can work together for the best interests of themselves and the business, can develop their fullest potential and find in their work experience not just economic and material rewards, but more importantly, the spiritual satisfactions of recognition and pride of personal accomplishment.

Based on a paper presented at the Midwinter Personnel Conference of The American Management Association, Inc., 1315 Broadway, New York 36, N. Y.



Value Analysis

By **N. E. Kewley**
General Electric Co.
Schenectady, N. Y.

Value analysis is not easy to define in a simple sentence. If any cost in a product does not contribute to making the product work or making the product sell, then get rid of it. If the cost item does contribute to work or sell, then study it to uncover the best answer while keeping in balance the items of cost, function, and essential quality. Make no mistake on this quality factor, cost reduction must not result in quality reduction. The only persons served by your quality reductions are competitors.

Whenever value analysis is presented to a new audience, the question from the floor goes, "What return on my investment should I expect to get upon installing a value analysis program?" We can't make outright statements regarding your business but probably you are fully guilty of supplying your customers with functionless frills equal to 5 percent of gross. In other words, a business doing 20 million dollars annual volume is probably peddling a million dollars worth of oversights which contribute neither to sales nor to function. It is suggested that a 20-million-dollar outfit should have a value analysis staff of three full-time employees. So the answer to the question is—can you afford three employees who will save you up to a million dollars a year? The size of the staff scales up and down with the size of your business. Our experience has been that a properly balanced staff can effect over-all savings year after year in the neighborhood of 5 percent of gross.

tech digests

Here are some questions to study before starting to use value analysis:

What will value analysis do for my business?

How do I sell it to top management?

How do I sell it to the other men of responsibility?

How will I actually get it started in this plant? (To whom will the value analyst report?)

How will we measure the value analysts while at the same time giving full credit for all savings to the men of responsibility?

Answers to these and other questions pertinent to your particular operation can get the operation off to a solid start which can mean more than doubling present cost reduction abilities.

Based on a paper presented at the Annual Meeting of the Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

Safety Engineering

By Henry B. Duffus

Administrator, Accident Prevention
Westinghouse Electric Corp.
Pittsburgh, Pa.

Engineering is still the key to industrial accident prevention. The safety engineer cannot be supplanted by someone without the proper technical background in some unnamed or unattached management profession. The challenge to us is to find and develop a sufficient number of men with the technical know-how to cope with our present day needs, and then delve into the untouched fields of human engineering and biomechanics, so that we can make equipments, operations and processes inherently safe.

Based on a paper presented at the Automotive & Machine Shop Power Press & Forging Meeting of the National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

High Temperature Sealing of Hydraulic Components

By A. B. Billet

Sr. Staff Engineer
Vickers, Inc.
Detroit, Mich.

Studies indicate that the sealing problems for these ever increasing temperatures and hyperenvironments will be met by a combined development effort of the hydraulic manufacturer, seal supplier, and fluid manufacturer. In respect to this, the continued development of elastomeric seals for even higher temperatures would eliminate some present

and future design problems.

Based on a paper presented at the National Aeronautic Meeting of the Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

Cumulative Damage Generalization

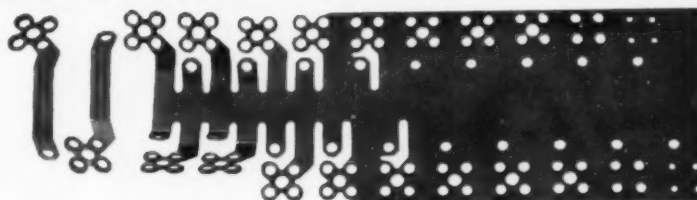
By R. M. Mains

Consulting Engineer
Kndls Atomic Power Lab.
Schenectady, N. Y.

In the application of various damage accumulation hypotheses to shock and

vibration problems, a pattern of results was observed. A plot of allowable response (for the largest of a sequence of excitations) versus the number of excitations in the sequence produced straight lines on log-log paper for each value of damping. It seemed likely that a generalization could be found which would relate the allowable response to the largest excitations with a load distribution factor, a material and structure factor and the material constants from fatigue tests.

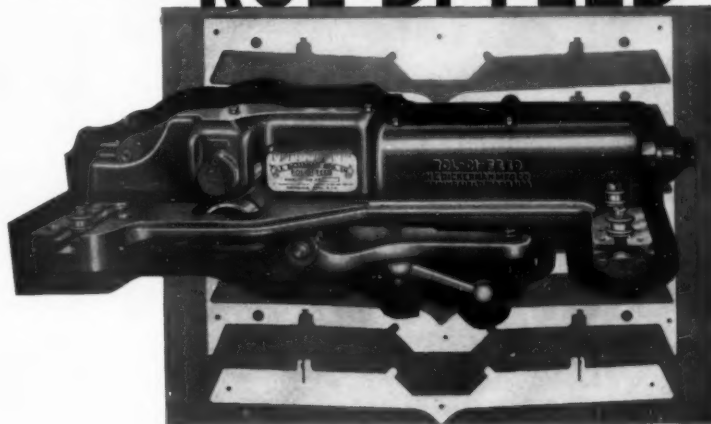
Based on a paper presented at the Metals Engineering Conference of The ASME, 29 W. 39th St., New York 18, N. Y.



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Muffler Acoustical Tests

By R. R. Regelbrugge
Hayes Industries, Inc.

What is Cold Acoustical Testing?
It is the method by which sound waves of known frequency and magnitude are sent into a silencing circuit at room temperature, with the intention of determining the effect of the silencing cir-

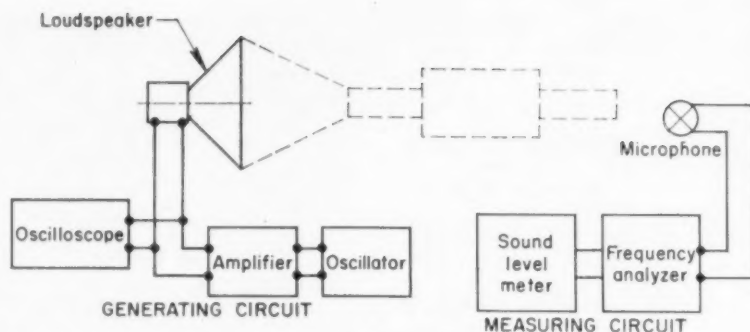
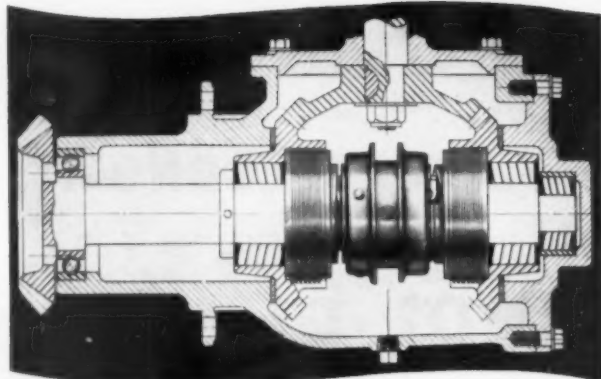


Fig. 1. Schematic diagram of sound generating and measuring circuits.

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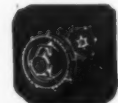
Small
Spring Loaded



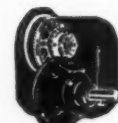
Heavy Duty
Spring Loaded



Oil or Dry
Multiple Disc



Heavy Duty
Over Center



Power
Take-Offs



Speed
Reducers

cuit on the characteristics of the input sound wave.

By careful analysis of the silencer sound output as compared to the known sound input, it is possible to determine the muffler attenuation for the input and test condition. It is absolutely necessary to restrict the test results to the particular conditions of the actual test, because of the great number of influencing factors not taken into account in the above test method.

Test findings, however, can be used as a guide even in final stage muffler development if:

1. The problem to be solved is of an acoustical nature.
2. The cold tests have been conducted as part of an over-all test program which includes dynamometer and/or on-the-road testing.

It is of interest to first take a look at the instrumentation required in a cold test setup. Fig. 1 gives schematic diagram of the sound generating circuit as well as the measuring circuit.

Major Restrictions and Disadvantages: Cold testing has two major types of disadvantages. The first type is caused by physical limitations of the instrumentation and the second type is a direct result of the fact that several important variables, present in engine exhaust noise are eliminated and their influence is therefore not taken into account in the cold tests themselves.

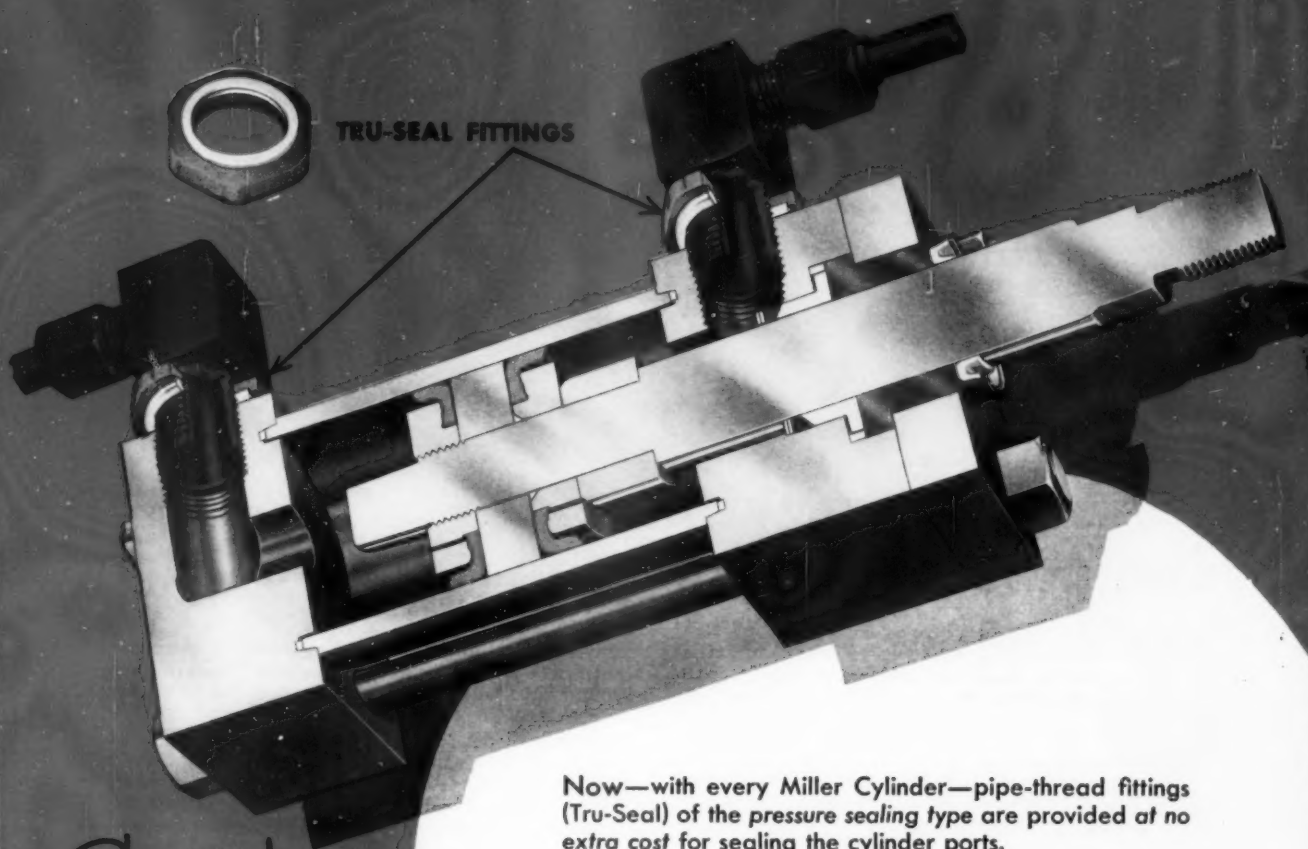
Conclusion: As a research tool, with the variables easy to control, it is obvious that cold testing is the most reliable test method. In final stage development, cold testing alone will not provide the answer. Used in connection with dynamometer and on-the-road testing, however, its value will become more and more evident.

Ed. Note: Similar equipment might find application in certain fields of machine tool research or workplace conditions tests.

Based on a paper presented at the National Passenger Car, Body and Materials Meeting of the Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

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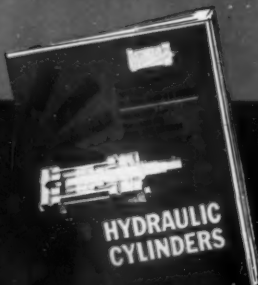
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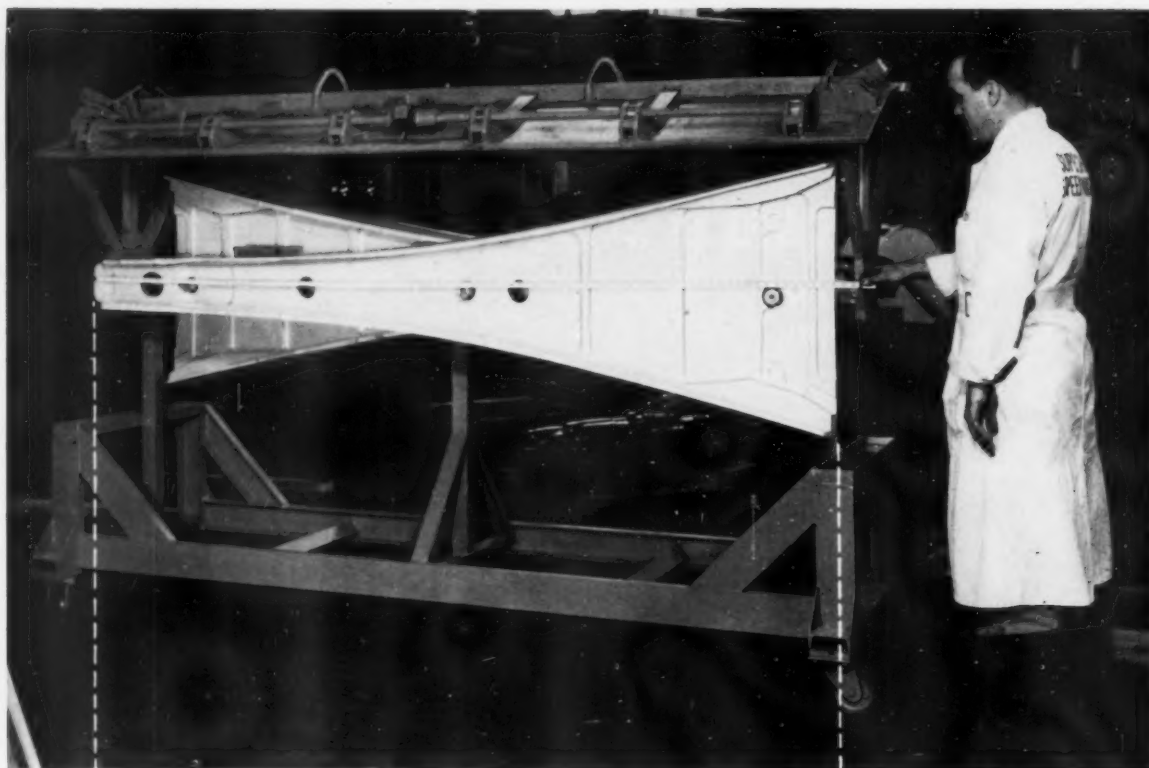
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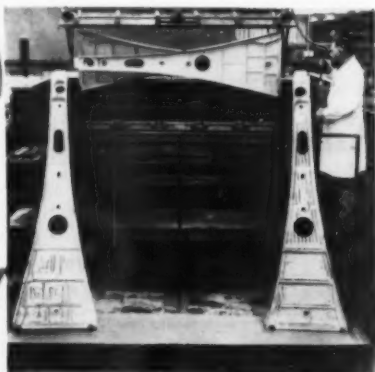
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These aircraft wing spars are barrel finished to blend in radii and improve micro-inch finish on other surfaces through use of ALMCO Supersheen media and

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Note "machining ridges" on foreground spars, prior to Almcobarrel Finishing. Supersheen Aluminum Oxide chips with Almcobarrel #10 compound are used in 2 hour finishing cycle.



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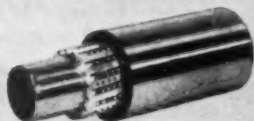
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- Single stroke, continuous and jog selector.
- Low air consumption.
- Large die area.
- Roller bearing flywheel.
- Bronze main and crank bearings.

CHOICE OF 30
SIZES AND TYPES
IN 5 TO 40-TON
PRESSES



SERVICE MACHINE CO.

Mfrs. of Rouselle Presses

2310 WEST 78th STREET • CHICAGO 20, ILLINOIS
ROUSSELLE PRESSES ARE SOLD EXCLUSIVELY
THROUGH LEADING MACHINERY DEALERS

USE READER SERVICE CARD, CIRCLE 113



NEW BALANCED CUTTING ACTION Severance ECARNO-MILLS THE ECONOMY MILL NEW DESIGN NEW CARBIDE

Make your money count! Replace more
H.S. Rotaries and Mounted Grinding Points



SOLID
CARBIDE
CUTTING HEADS

22 Shapes and
Sizes Available



A NEW
LOW PRICED
HIGH CLASS
PERFORMER

Made by the originator of ground-
from-the-solid Rotary Files, and pio-
neer in this type of Carbide Mill, who
presently offer the largest range
of standard types, shapes, and sizes.

OPERATE EFFICIENTLY AT USUAL CARBIDE
SPEEDS, YET PERFORM BEAUTIFULLY AT THE
SLOWER SPEEDS OF STEEL CUTTERS

PHONE, WIRE, OR WRITE US NOW
FOR PRICES

Severance TOOL INDUSTRIES INC.

728 Iowa Avenue • Saginaw, Michigan
Ask for a Severance catalog today!

USE READER SERVICE CARD, CIRCLE 114



Look — at these sheared tubular ends — clean,
true contoured and close fitting with a minimum of
burr and distortion . . . You can make them fast,
some up to

2000 an hour with Vogel patented
tools. Or, if you prefer, we can do your notching,
shaping, shearing and perforating . . . Either way
You save on cost!

ARC-FIT® notches up to 720 per hour.

ARC-SNUG prepares pipe ends for snug brazing—up to
500 pieces per hour.

ARC-TWIN® double notches pipe up to 750 pieces per hour.

CUT-OFF shears tubing in two up to 2000 per hour.

Samples of shearing and notching
(also estimates) gladly furnished
without obligation.

VOGEL TOOL & DIE CORPORATION

1821 N. 32nd Ave., Stone Park, Ill.

USE READER SERVICE CARD, CIRCLE 115

NOW... 2 TORQUE Ranges (to 900 Foot pounds)



both from one
STURTEVANT
TORQUE WRENCH

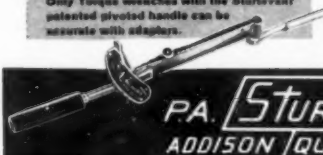
Now you can do high torque work with a Sturtevant
Torque Wrench of normal capacity range—small in
size—light in weight—with fine increment markings
and moderately priced.

With a new Multi-range, Multi-purpose Adapter you
can step up the capacity of your Torque Wrench to a
new high range and you can plug in any drive end you
want . . . Box wrench, ratchet, drive square for sockets.

All drive end accessories are interchangeable and
stock items.

In this way each Sturtevant Torque Wrench effec-
tively equals two complete sets of ordinary single
purpose Torque tools.

Only Torque wrenches with the Sturtevant
patented pivoted handle can be
accurate with adapters.



WIDE CHOICE OF INTERCHANGEABLE DRIVERS



write for No. SD-77 catalog sheet

P.A. **STURTEVANT CO.**
ADDISON QUALITY ILLINOIS

USE READER SERVICE CARD, CIRCLE 116

The Tool Engineer



The X-ray fluorescence analyzer, one of the many modern instruments in the chemical laboratory, helps Jessop make certain you get the specified per cent of each alloy in your specialty steel.

"How X-rays help Jessop give you exactly what you want in alloy steels . . ."

—C. M. Carlisle, Director of Analytical Chemistry

"What's happening here? As the stylus in the X-ray fluorescence analyzer draws red lines on the graph, the Jessop chemist determines the exact per cent of each alloy in a sample of specialty steel.

"Based on this analysis, the melter may ask for the addition of, say, molybdenum to the molten steel now in electric arc furnace No. 3.

"How's it done? Bombarded by X-rays, the alloys in the sample of steel are radiating secondary rays. Converted into electrical energy, the rays are causing the stylus to move and draw red lines on the graph . . . indicating the types and per cent of alloys in the steel sample."

In the Jessop chemical laboratory, the X-ray fluorescence analyzer and many other modern instruments help us make certain you get the exact chemical composition specified in your order. This chemical laboratory is one more reason for your confidence in ordering specialty steels from Jessop. *Specify Jessop . . . and then relax!*

JESSOP
STEEL COMPANY
Washington, Pennsylvania

VMA 6739

Subsidiary Companies:

Green River Steel Corporation, Owensboro, Kentucky • Jessop Steel International Corporation, New York City
Jessop Steel of Canada, Ltd., Wallaceburg, Ontario • Steel Warehousing Corporation, Chicago, Ill.

Stainless, alloy, tool, cast-to-shape, and forging steels, precision ground flat stock, and other specialty steels

USE READER SERVICE CARD, CIRCLE 117

Check your skill in tap selection with this **HY-PRO "TAP-nology" TEST**

HSS 2 flute
spiral point GH 2
Hy-crome finish

NICKEL-IRON PART

Tap through hole with #0-80 tap in missile part made of extremely tough and abrasive 50% nickel — 50% iron alloy. Machine tapping.

Which tap would you choose?

HSS 2 flute
plug point GH 2
Ferrox finish

The HY-PRO #311 tap with Hy-crome finish (left) produced *5.7 times* the number of holes per tap obtained with the 2 flute plug tap.

HSS 2 flute
spiral point GH 7
bottoming
Nitride finish

PLASTIC PART

Tap blind hole with #8-32 tap in extremely abrasive high-temperature thermosetting plastic. Semi-automatic machine tapping operation.

Which tap would you choose?

HSS 3 flute
GH 7 bottoming
Hardernell finish

The HY-PRO #510-5 tap with Hardernell finish (right) produced *11.3 times* the number of holes per tap obtained with the 2 flute spiral point tap.

HSS no flute
spiral point GH 3

STEEL STAMPING

Tap through hole in thin 1020 steel stamping with #6-32 tap. Poor alignment of tap with hole. Finished hole must be burr-free. High production semi-automatic operation.

Which tap would you choose?

HSS 3 flute
plug point GH 3

The no flute spiral point tap. HY-PRO #315 with ferrox finish (left) produced up to *12.4 times* as many holes per tap as the 3 flute plug point tap.

Call your local
HY-PRO DISTRIBUTOR
for standard taps
FROM STOCK



If you picked the wrong taps, don't be surprised. Most tap users make similar errors, without realizing it, when they buy taps by "habit," instead of by comparative performance.

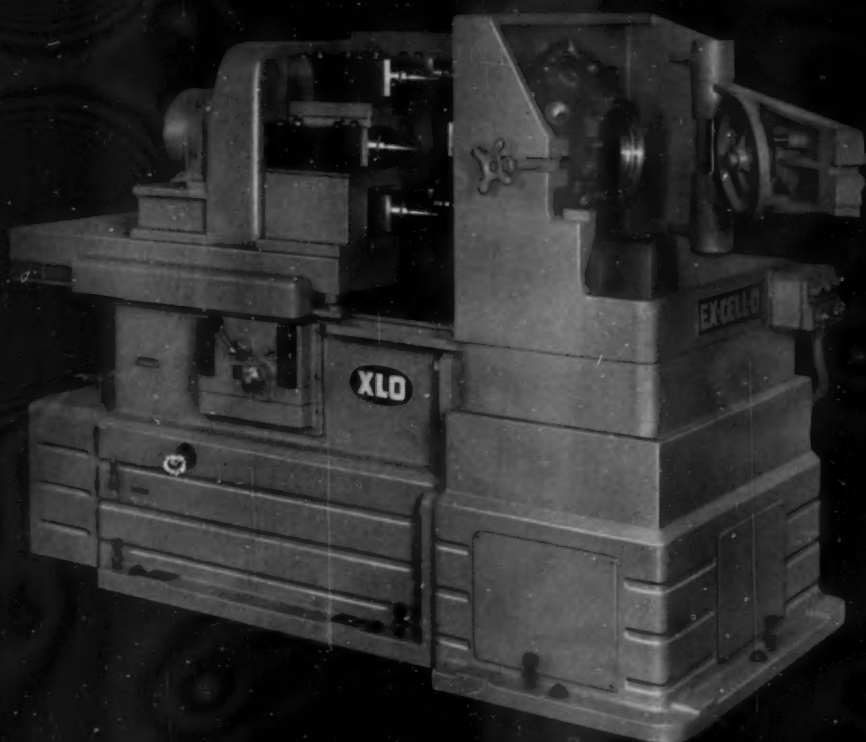
These examples show *how much it pays you* to be right about taps. Selection today takes more tap knowledge than ever, with so many new metals, alloys, and plastics in industrial use.

To make sure your "tap-nology" is up to the minute, consult HY-PRO tap engineering specialists. It costs nothing, and records prove it is often the first step to big savings. Write: Dept. C.

HY-PRO TOOL COMPANY
DIVISION OF CONTINENTAL SCREW CO.

NEW BEDFORD, MASS., U. S. A.





It's a 'special' –
but it's ready to do
other jobs, any time!

An Ex-Cell-O Way-Type unit can be a special-purpose production machine, or used with other units as an automated machining line. Various arrangements are outlined below.



ONE WAY



TWO WAYS AT 180°



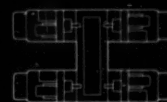
TWO WAYS AT 90°



THREE WAYS



FOUR WAYS



MULTI WAYS

59-21

Ex-Cell-O Way-Type units use standard components for economy, flexibility...

Ex-Cell-O Precision Way-Type Machines let you arrange and re-arrange combinations of standard machine components to create your own special machines for each new job. A self-contained Way unit consists of a base, a slide, and hydraulic power and controls to operate the slide; a universal end section supports the work fixture.

The typical single-unit Way Machine above bores and chamfers six holes at one feed stroke in a magnesium aircraft component. Hole locations are held to .001" tolerance, and finish bore diameters are accurate within plus or minus .0005".

Your local Ex-Cell-O Representative will welcome the opportunity to suggest other profitable Way Machine applications in your operation. Call him, or contact Ex-Cell-O, Detroit.

EX-CELL-O FOR PRECISION

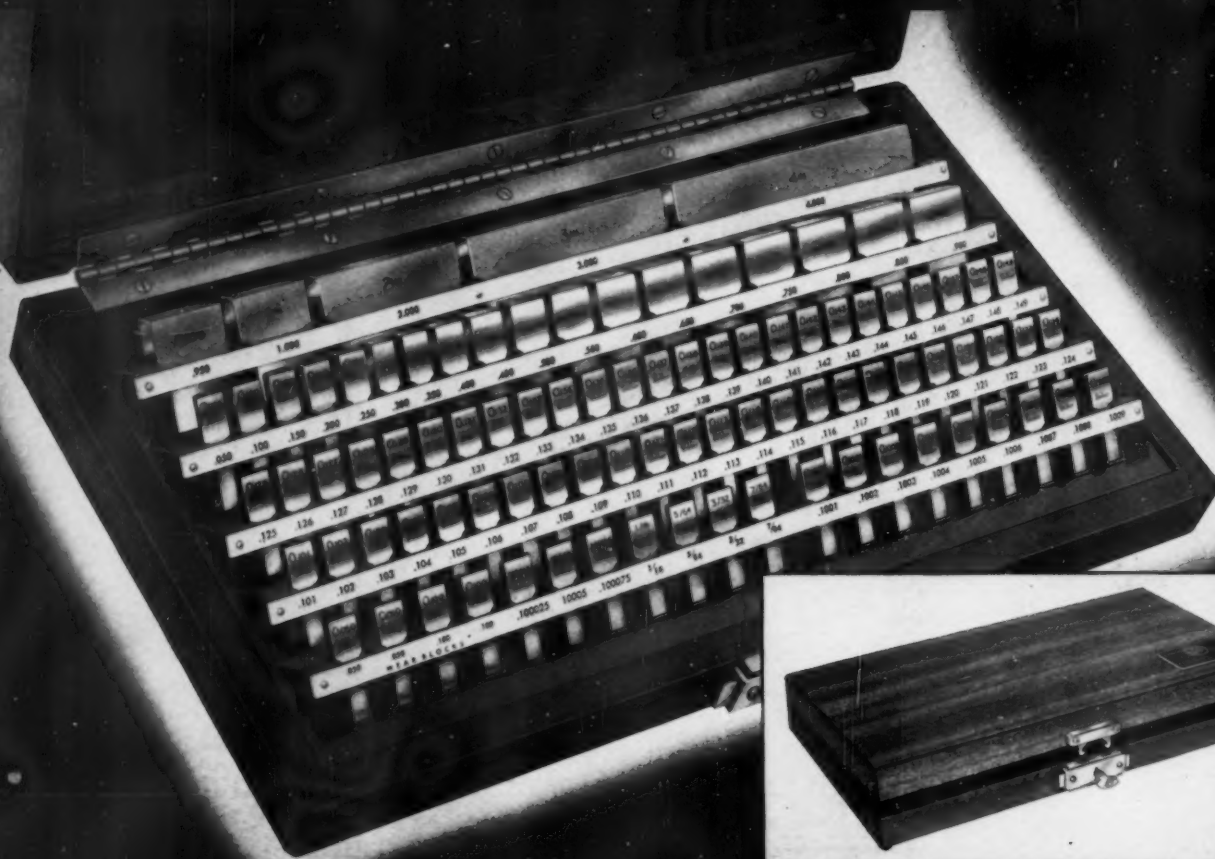


EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN

*Machinery
Division*

EX-CELL-O PRECISION PRODUCTS INCLUDE: MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS TORQUE ACTUATORS • THREAD AND GROOVE GAGES • GRANITE SURFACE PLATES AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

USE READER SERVICE CARD, CIRCLE 119



THE CASE, also new and greatly improved, is made of finest quality, frosted walnut grain Melamine, with Bakelite interior. (Patent pending.)

Webber ANNOUNCES

A New Superior Gage Block, "A+" $\begin{matrix} +.000004 \\ -.000002 \end{matrix}$

Priced lower than former "A" and "B" sets.

These new blocks actually exceed U. S. Bureau of Standards or Federal specifications for Grade "A" blocks. Yet WEBBER has priced them even lower than now obsolete "B" blocks!

A COMPLETE **\$ 287 50**
84 block set only

including two .100 Croblox (chrome carbide) wear blocks.

New, **HIGHER** Accuracy

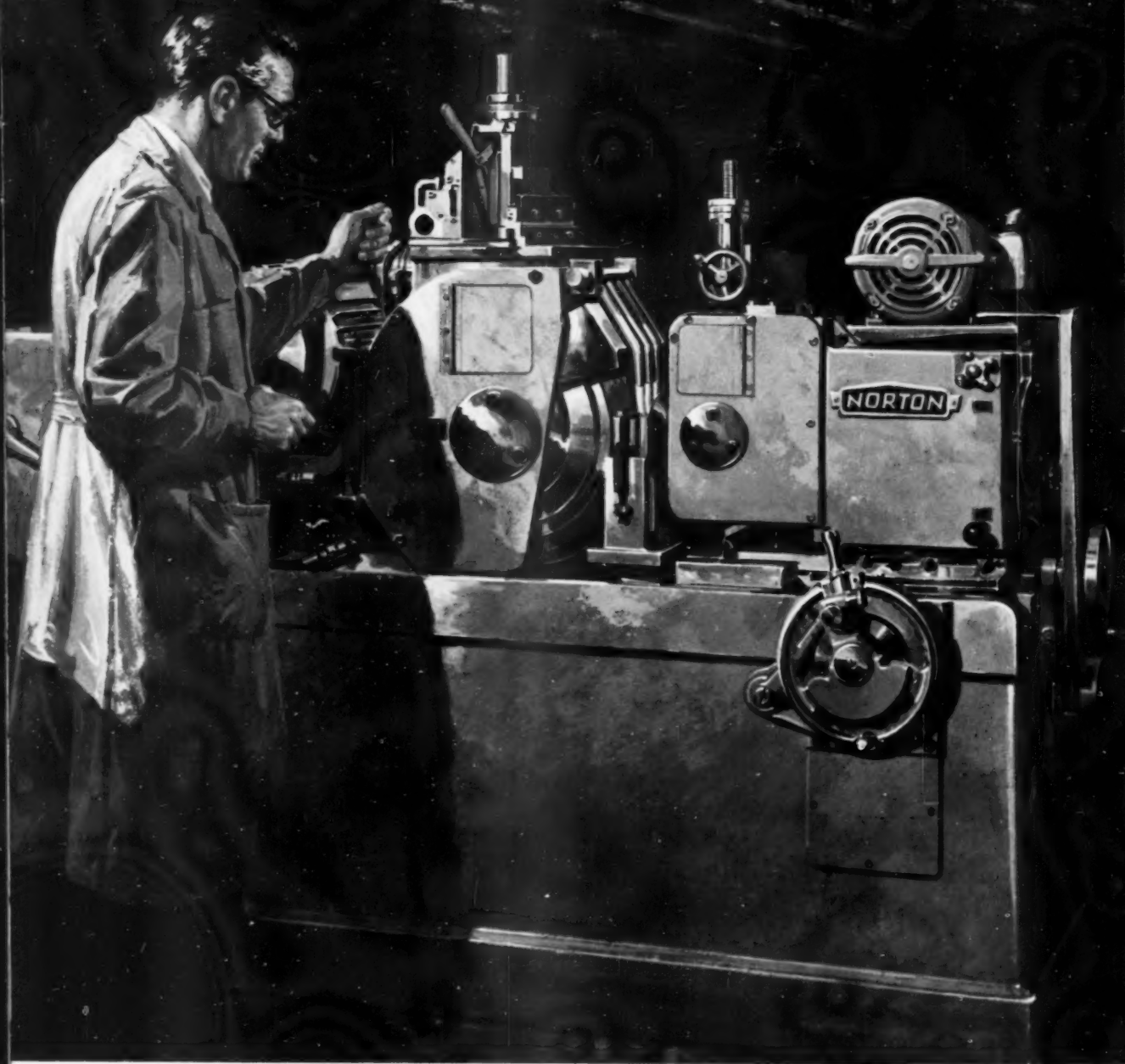
New, **BETTER** Case

New, **LOWER** Prices



Webber GAGE COMPANY 12908 Triskett Road
Cleveland 11, Ohio
Largest exclusive manufacturers of precision gage blocks

Don't wait! Write today direct to WEBBER for your free copy of folder describing this REVOLUTIONARY BUY.



**Now you can add the
"Touch of Gold"
... with the new Norton centerless grinder**

The ability to produce better products at lower cost is an *extra* built into every Norton grinding machine.

Now, for the first time, this "Touch of Gold" performance is available in a centerless grinder. The new Norton No. 2 Centerless Grinder,

the latest addition to the world's largest line of grinders and lappers, is ready for immediate delivery.

How this sensational new grinder can help you get a new start against competition is worth knowing. Get the whole story from your Norton

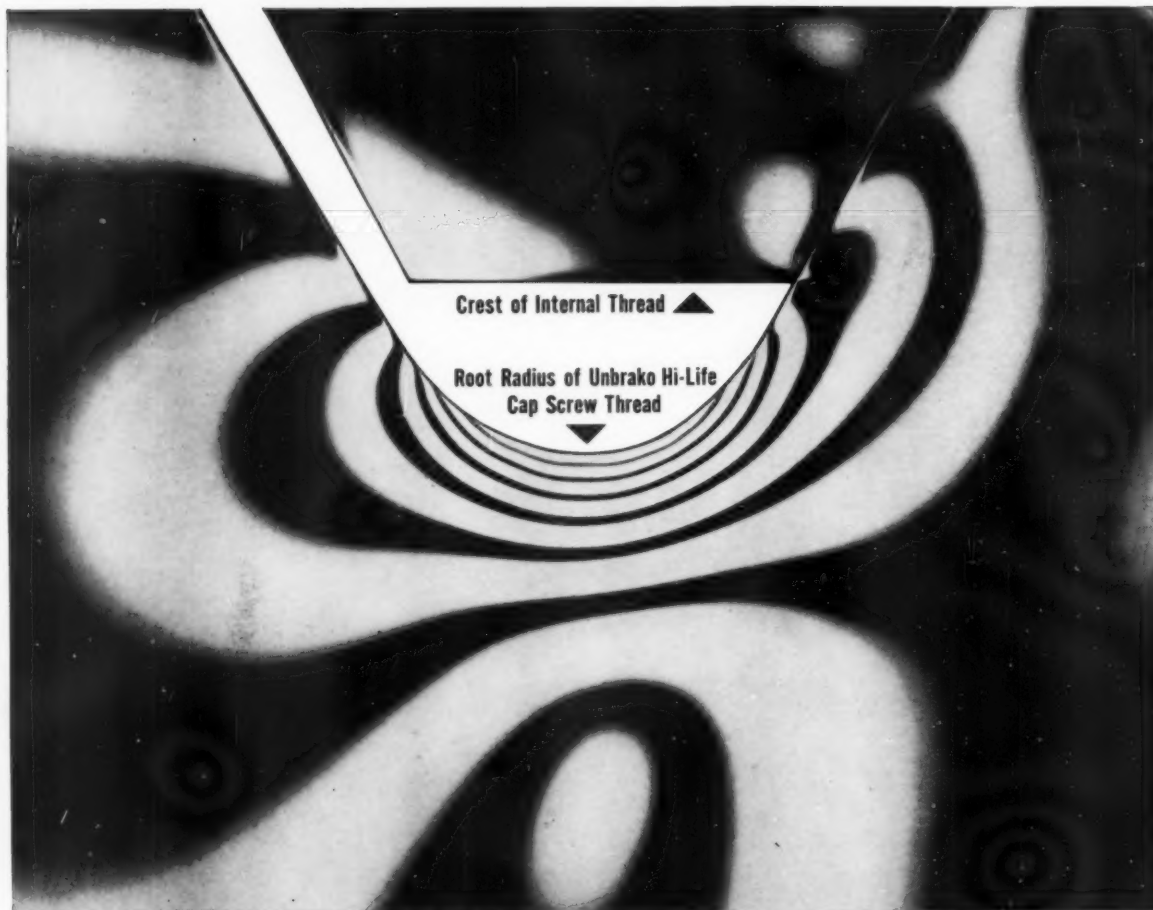
Man, soon. NORTON COMPANY, Machine Division, Worcester 6, Mass.



Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electrochemicals — **BEHR-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

The big change is in the threads



STRESSES ARE DISTRIBUTED. Photoelastic study shows how the thread root radius of the new UNBRAKO Hi-Life socket cap screw blends smoothly into the flanks of the threads to reduce stress concentration and increase fastener fatigue life.



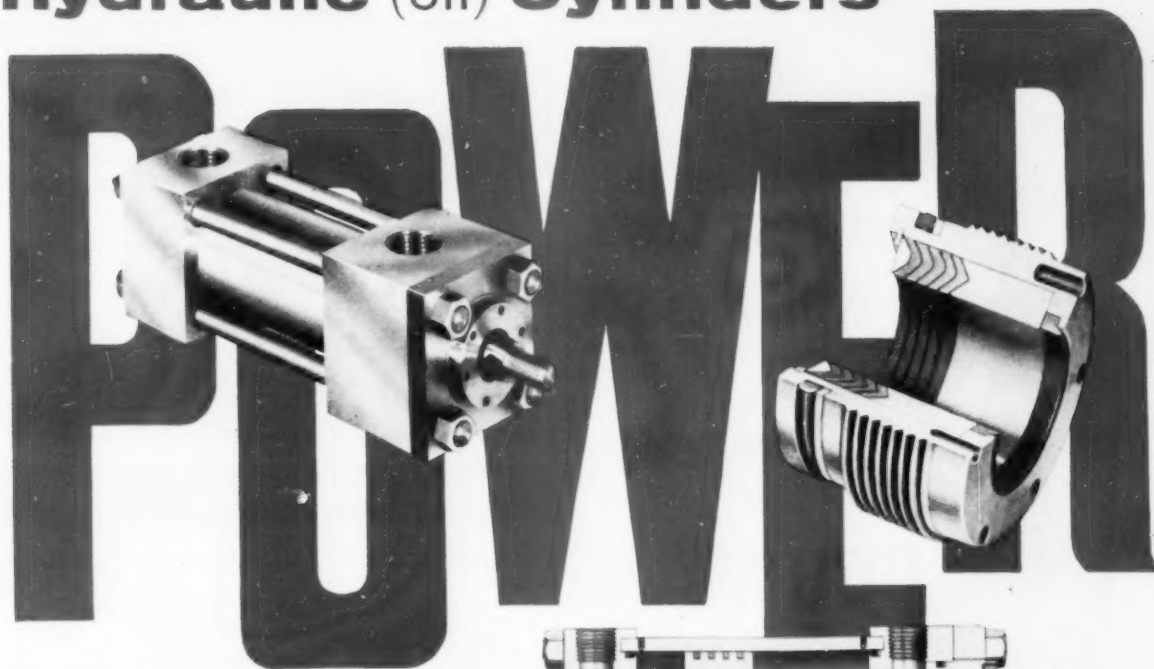
Improved thread root form, developed by SPS research on high-strength fasteners, now standard on all new UNBRAKO Hi-Life socket head cap screws. And at no increase in price.

Radiused thread root lengthens fatigue life as much as 100% and increases tensile strength of new UNBRAKO Hi-Life socket cap screws. For the first time, this high-strength thread design is available to industrial users. Higher reliability of new fasteners provides assurance of longer life for your product. Bulletin 2577 gives complete details. Ask your authorized SPS industrial distributor for a copy. Or write SPS—manufacturer of precision threaded industrial fasteners and allied products in many metals, including titanium.

INDUSTRIAL FASTENER Division **SPS**

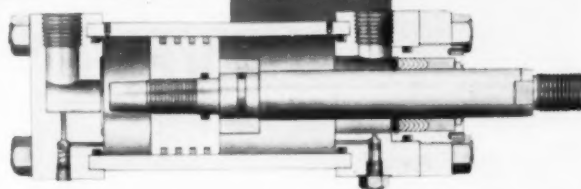
JENKINTOWN 37, PENNSYLVANIA

there is **power**
to spare in
O-M heavy-duty
Hydraulic (oil) Cylinders



Series TH

2000 psi operation • 3000 psi non-shock
Available in 1½" to 8" bores
Meet JIC Standards



If you need smooth, dependable straight-line motion for heavy-duty pushing, pulling, elevating, lowering, clamping or knock-out operations, these powerful, O-M components have what it takes and more, too. To deliver this plus in power, every essential design and construction feature has been employed.

For example, these units are ruggedly constructed of heavy wall seamless steel tubing microhoned to minimize friction. The ports are large and unrestricted. They can be located at 90-degree positions. These cylinders are sealed right to prevent power loss. The piston rod is stress relieved, turned, ground and polished, high tensile steel, chrome plated. In addition, the rod gland cartridge, accurately piloted in the rod head to assure perfect alignment, is easily unscrewed and removed. Pilot O.D. of cartridge serves as pilot for cylinders mounted on rod end. A cushion ball check valve provides for rapid, full power start of return stroke.

These and many other advancements are described in our latest catalog No. 105. Write for your copy TODAY or consult your local O-M representative.

ORTMAN-MILLER MACHINE COMPANY

13 143rd Street, Hammond, Indiana



- ☐ Have representative call
☐ Send Bulletin 105

Name _____ Position _____
Company _____
Address _____
City _____ Zone _____ State _____

**"REMOVABLE"
TAPER
SHANKS
for
Small Tools**



**Cut Your Costs
with these**

Glenzer

**UTILITY
SLEEVES**

**You get economy
of Straight Shank Tools
with
Taper Shank Convenience!**

They supply removable taper shanks for number, letter, and fractional drill sizes, and other small tools — #1 thru #7 Morse tapers, #7 thru #13 Brown & Sharpe Tapers, and A.S.A. .239, .299, .375, and 4½ tapers.

Standard in leading automobile and many other plants — large and not so large — since 1919.

Send for Circular Index A

THE J. C. **GLENZER** CO., Inc.

1552 E. NINE MILE ROAD, DETROIT 20, MICH.

USE READER SERVICE CARD, CIRCLE 123

**ACCURACY
.0002 T.I.R.**

.0002 T.I.R. or less at Spindle Nose, .0005 T.I.R. or less on Test Arbor six inches from Spindle Nose

**SPINDLE
SPEEDS
150 and
250 RPM
Other Spindle
Speed Pulleys
Available**

**MODEL B943
MOTOR DRIVEN
WORK HEAD**



No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost.

Clip ad to your letterhead and send for Literature

K. O. Lee Company, Aberdeen, S. D.

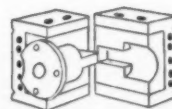
USE READER SERVICE CARD, CIRCLE 124



Repairing broken dies



Anchoring punches & dies



Holding irregular work pieces

**3 Time-Saving
CERROTECHNICS Shortcuts**

These and 60 other CERROTECHNICS applications are saving time and money in many metalworking operations. CERROTECHNICS embodies practical methods of using bismuth alloys (CERRO† ALLOYS) in a wide variety of industrial applications. CERRO ALLOYS . . . low-temperature-melting metals . . . simplify and shortcut many intricate operations. Send for the complete list of CERRO ALLOY applications . . . it can help you make substantial savings in tooling and production costs.



†T.M. Cerro de Pasco Corporation.
*63 Applications at the latest count.

CERRO DE PASCO SALES CORPORATION

Room 1503, 300 Park Avenue, New York 22, N. Y.

USE READER SERVICE CARD, CIRCLE 125

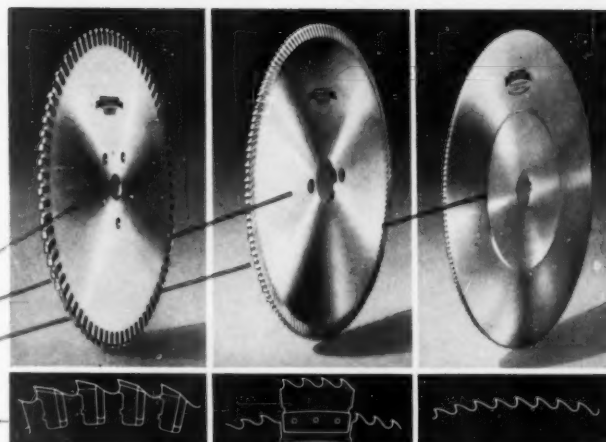
Do you cut ferrous metals? If so, Simonds has three basic saw designs for you:

INSERTED TOOTH METAL SAWS

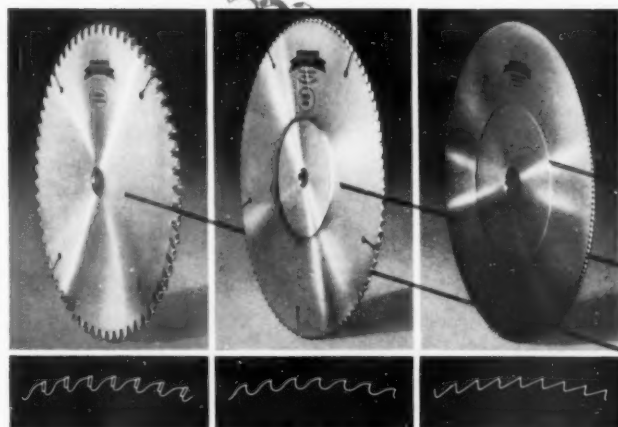
SEGMENTAL SAWS

SOLID TYPE SAWS

Available in High Speed and Semi-High Speed Steels



There's a
SIMONDS Circular Saw
Exactly Right for Your
Metal Cutting Job



If you're cutting non-ferrous metals, Simonds offers you:

SOLID STEEL SAWS

Available in "Si-Maloy", in High-Speed Steel for cutting where extreme abrasiveness is present, and in Semi-High Speed Steel.

HIGH SPEED STEEL, HARD RIM SAWS

Hard cutting edge, soft center gives you long life coupled with safety.

CARBIDE TIPPED SAWS

for cutting aluminum and magnesium, as well as other non-ferrous metals

No matter what kind of metal you're working, there's a quality Simonds blade just right — a blade that means faster, cleaner cuts, longer blade life and maximum performance.

Find out how a Simonds Circular Metal Cutting Saw can mean important savings for you.



For Fast Service from Complete Stocks Call your

SIMONDS Industrial Supply DISTRIBUTOR



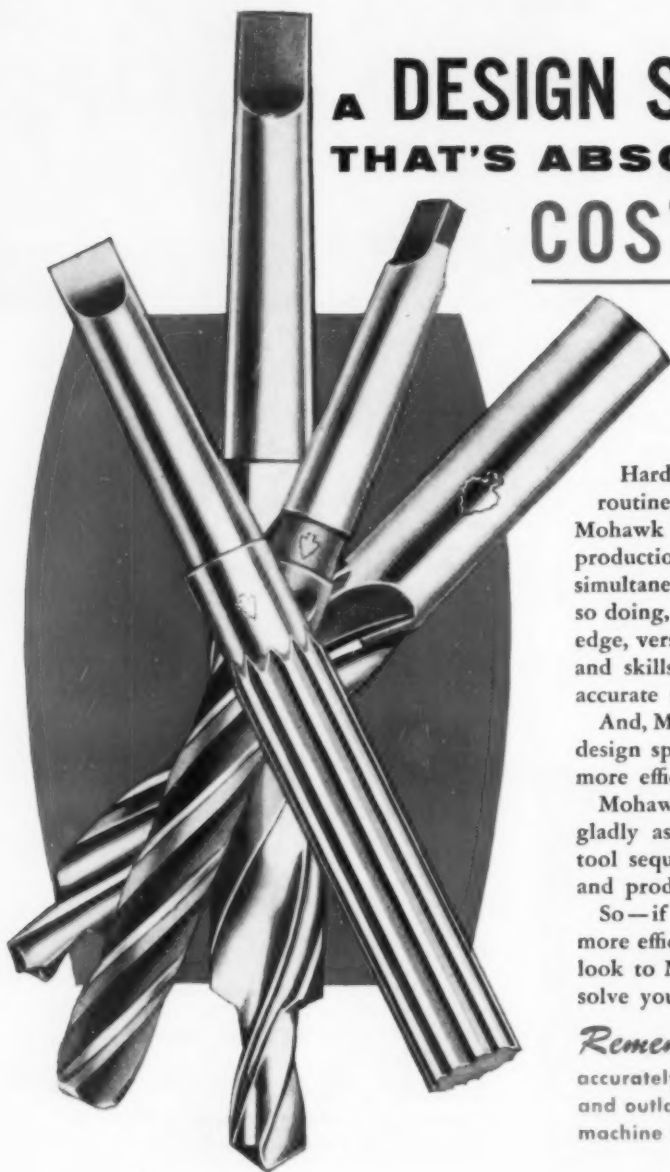
SIMONDS SAW AND STEEL CO.

FITCHBURG, MASS.

Factory Branches in Boston, Chicago, Meridian, Miss., Shreveport, La., San Francisco and Portland, Ore., Canadian Factory in Montreal, Que., Simonds Divisions: Simonds Steel Mill, Lockport, N. Y., Heller Tool Co., Newcomertown, Ohio, Simonds Abrasive Co., Phila., Pa., and Arvida, Que.

ENGINEERS!

A DESIGN SERVICE THAT'S ABSOLUTELY COST-FREE



Hard to believe? Certainly . . . yet completely true, routine procedure at Mohawk. And here's why. Mohawk has long pioneered the functional, economical production and application of modern cutting tools for simultaneous drilling of multi-diameter cavities. And, by so doing, has developed the sound engineering knowledge, versatile talents, exclusive manufacturing methods and skills necessary to produce the world's finest, most accurate tools.

And, Mohawk will, *without obligation*, recommend and design specialized cutting tools in order that you may more efficiently accomplish those difficult jobs.

Mohawk does more than manufacture tools, they will gladly assist in determining the proper tools and/or tool sequence for specific operations . . . then develop and produce the proper tools for you.

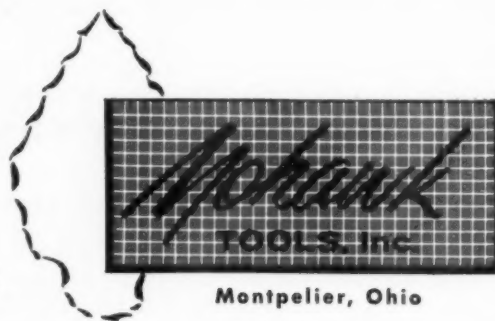
So—if you'd like to remedy an existing problem, or more efficiently tool up for a new application, why not look to Mohawk—the *one* dependable source that can solve your problems and save you money.

Remember . . . Mohawk's properly designed, accurately produced, quality tools outwork, out-perform and outlast ordinary tools and save manhours, set-ups, machine time and eliminate costly separate operations.



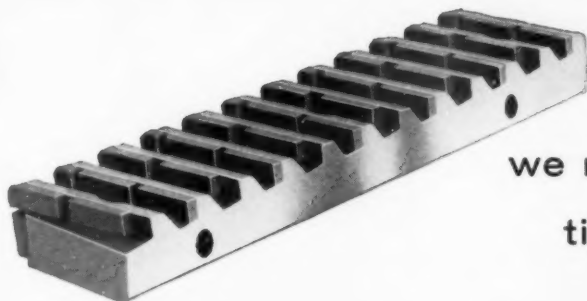
"Design 13" . . . a new pocket-size booklet was prepared especially to acquaint you with Mohawk's cost-free Design Service—plus illustrated examples to assist in more easily determining your needs. "Design 13" is yours for the asking!

world's largest producer of Sublands



Montpelier, Ohio

Everybody knows that
National Tool Company
makes special hobs—



But did you know
we make special carbide
tipped surface broaches...

and more special cutting tools of all kinds
than any other tool manufacturer?

For more than half a century National Tool Company
has supplied high quality precision cutting tools to
the metal working industry. When your job
requires special cutting tools call your National Tool
representative. His assistance is yours for the asking
whether you're interested in one special tool
or a complete tooling program.



National
TOOL CO.
Cleveland 2, Ohio

Representatives in major industrial centers

New FREE Catalog

To National Tool Co., 11200 Madison Ave., Cleveland, Ohio

Please send NEW 92 page catalog showing National Tool Company's complete line
of special tools for the metal-working industry.

Name

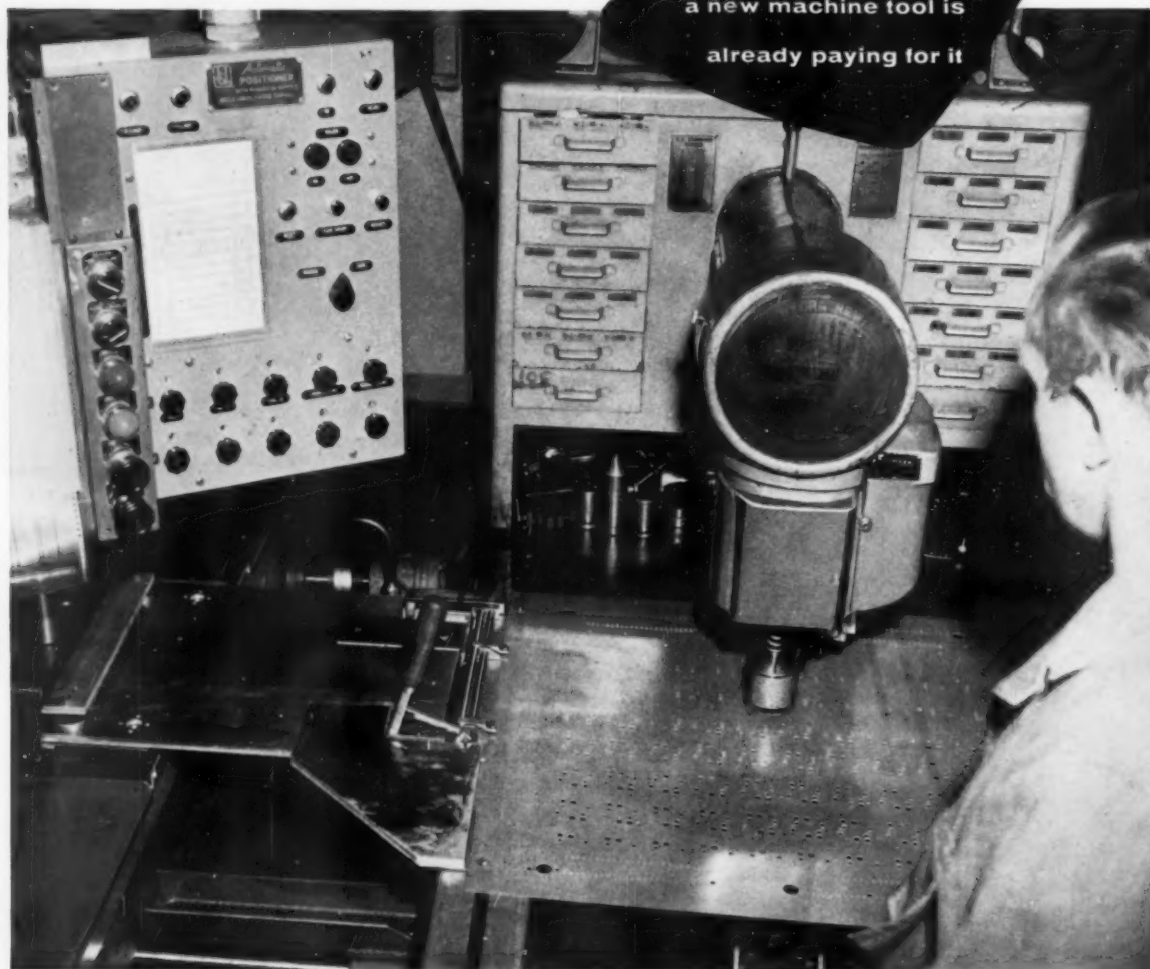
Position

Company

Address

City Zone State

JONES & LAMSON "AUTOMATION"



This Tape Controlled Setup Punches 1483 holes – of 11 different sizes – in just 85 minutes

How's this for small lot automation? The problem is to produce 50 parts, each having 1483 holes of 11 different sizes. Hole location must be $\pm .002''$. Delivery — 2 weeks.

J & L's numerical control positioning table, applied to a standard punch press, does the job with minimum lead time, production time, and cost. Here's how:

The entire tape programming for this complicated part takes only 15 hrs. There are no fixtures, templates, or dogs to be made and set. No gang tooling to prepare. No appreciable setup time.

The operator simply inserts the prepared

tape, locates the work piece and pushes a button. The positioning table is then automatically controlled in any pre-arranged, random pattern. Therefore there are only 11 tool changes for the 11 sizes of holes. And — this unit tells the operator when and what tool to change.

A completed part comes off the machine every 85 minutes. Changeover for other jobs is just a matter of changing tapes and tools.

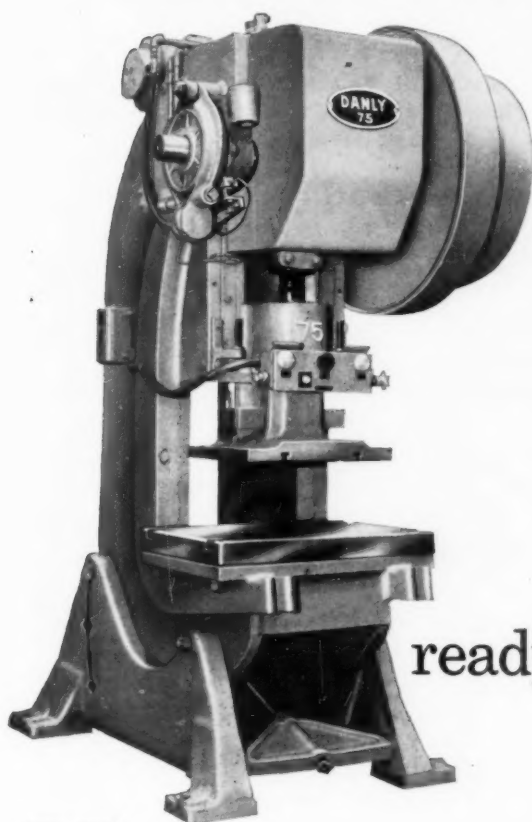
Investigate how tape control can help increase the efficiency of *your* operation. Write to Jones & Lamson Machine Company, 518 Clinton Street, Springfield, Vermont.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools



The Newest Products for the Stamping Industry

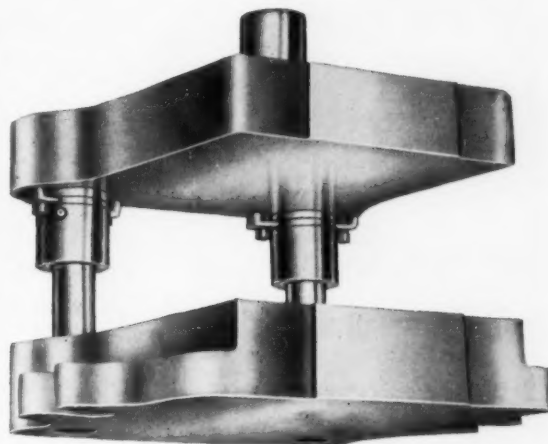
in
PRESSES



From stock

Danly's Open Back Inclinable Presses bring big press efficiency to the small press field. Each O.B.I. Press - capacities from 25 to 200 tons - is equipped with the exclusive Danly Air Clutch and Brake. This Clutch gives these presses all the reliability and flexibility of operation of the Danly Straight Side, Underdrive and Autofeed Presses. The clutch of "low inertia" design wears less because of low weight load picked up on each engagement. It runs cooler and costs less to maintain. The ruggedness of heavy welded steel frame construction engineered into all Danly Presses, features this new O.B.I. line. The rugged construction throughout minimizes vibration, deflection and breakage. In combination with Danly Air Friction Clutch it assures long press life—continuity of production—accurate stampings—low cost of production and maintenance. This new line is priced for economy.

in
DIE SETS
and Die Makers' Supplies



ready for immediate delivery

Stocked and assembled in 20 tool-making centers

Now all Danly Precision and Commercial Die Sets are assembled with demountable bushings and press-fit guide posts—to provide the most accurate die sets on the market. Chance of distortion is minimized. Posts and bushings are pre-fitted to dimensions, within tolerance, at the factory and furnished as matched units in all die sets. Pre-fitting is so accurate that bushings and guide posts are completely interchangeable.

To this new precision, Danly also adds unequalled availability made feasible by this new method of assembly. These die sets are stocked for prompt assembly and delivery by 20 factory branches and distributor assembly plants throughout the country. Your local Danly outlet is your source for die sets and toolroom and pressroom supplies that bear the stamp of leadership.

WRITE DANLY TODAY

Write us and your distributor or branch will place the money-saving facts about these newest Danly products before you.

DANLY MACHINE SPECIALTIES, INC.

The Leading Supplier



2100 S. Laramie Avenue, Chicago 50, Illinois
to the Stamping Industry

1020 CAMSHAFTS MACHINED WITH **Talide**® C-91!



• A leading automobile manufacturer was experiencing low tool life and high costs machining camshafts made of tough, highly abrasive cast iron alloy. Talide tool engineers installed Grade C-91 with the following superior results:

GRADE C-91 CASE HISTORY

Part.....Automobile camshaft

Material....Cast Iron Alloy 1.8165 dia. x 23 1/2" long, 260 Brinell

Operation.. Rough turning 4 bearing surfaces

Machine....Sundstrand Model #8 automatic

Tools.....4 Talide TB-123 3/8" I.C. x 1-1/2" long triangular inserts, Grade C-91, mounted in Klamp-Lok toolholders

Depth of Cut.. 1/16" to 3/32"

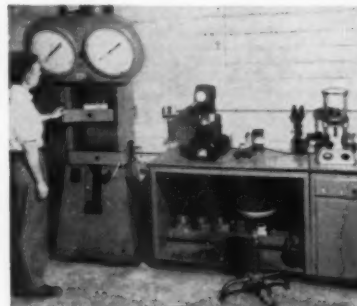
Feed......012

Speed.....130 (S.F.M.) 274 (R.P.M.)

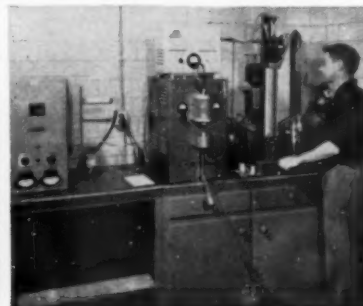
Coolant.....Soluble Oil

Results.... Talide Grade C-91 machined 1020 camshafts per grind compared to 550 for 2nd best competitive grade and 275 for 3rd best. Special attention to the grind and chip breaker detail resulted in Grade C-91 outperforming all other grades used previously.

QUALITY CONTROL GUARANTEES TOP TOOL PERFORMANCE...



Determining rupture strength of test bar. Hardness is determined on Rockwell machine, center.

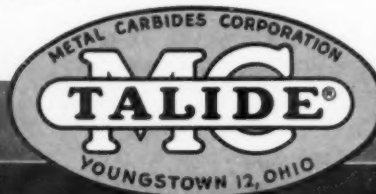


Leco and Burrell instruments are employed in the analysis of metal oxides.

• A constant research program at Metal Carbides pays off in improved Talide grades having extra high hardness, strength, rupture resistance and crater resistance properties. Processed in latest type vacuum electric furnaces—all Talide grades are uniform and consistent in quality.

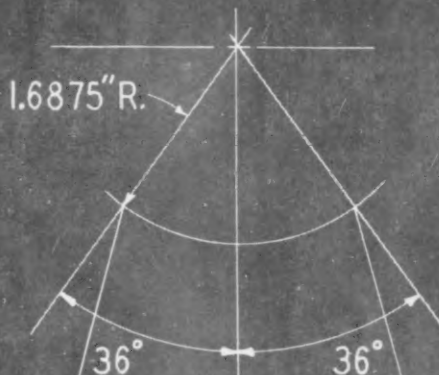
Write for
Catalog 56-G

Metal Carbides
Corporation
Youngstown 12, Ohio



HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY





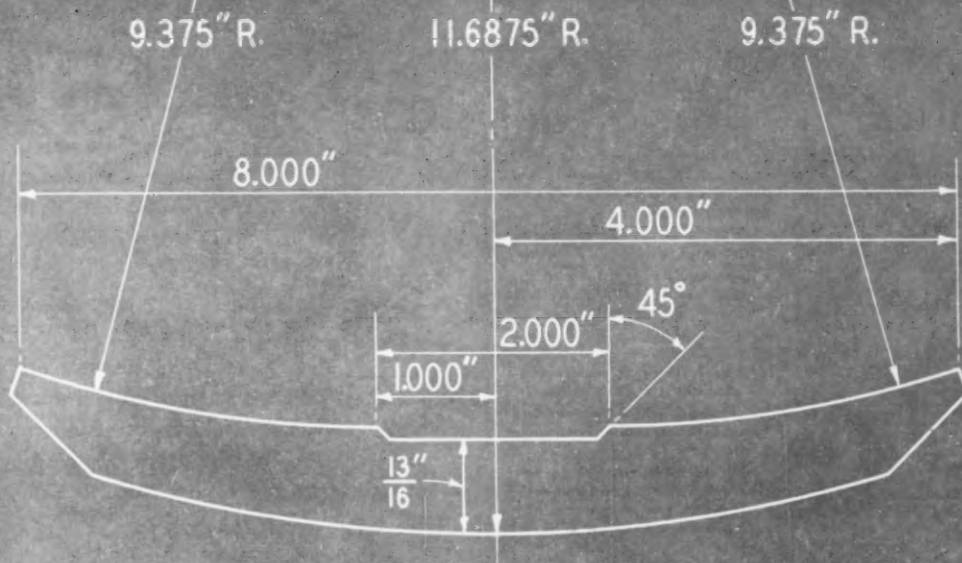
2 RADII, 3 SURFACES CUT IN ONE OPERATION!



Looks difficult to do? Shop management at Blanchard Machine Company, Cambridge, Mass., made it a simple production job using a standard Fellows Gear Shaper. Eight of these segments are shaped at one time, as shown in the photograph. A special gear shaper cutter generates all of the internal surfaces in one-cutting operation. The segments are then simply cut apart, drilled and tapped. The pieces are segment clamps to hold grinding wheel sections in the Chuck for the Blanchard Surface Grinder. The same Fellows Gear Shaper, using appropriate cutters, can produce an almost infinite range of non-circular shapes, simple or complex, as well as internal and external spur, helical and herringbone gears, and gears close to shoulders or in recesses. The advantages of the Gear Shaper are illustrated in "The Art of Generating with a Reciprocating Tool." If you would like a copy just write us. THE FELLOWS GEAR SHAPER COMPANY, 70 River Street, Springfield, Vermont. Branch Offices: 1048 N. Woodward Ave., Royal Oak, Mich.; 150 W. Pleasant Ave., Maywood, N.J.; 5835 W. North Ave., Chicago 39, Ill.; 6214 W. Manchester Ave., Los Angeles 45, Cal.

FELLOWS

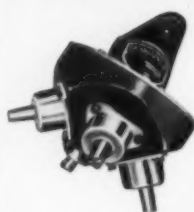
VERSATILITY IN GEAR PRODUCTION EQUIPMENT



STREAMLINE YOUR DRILL PRESS OPERATIONS WITH . . .

quadrill

(4 POSITION)
(TURRET HEAD)



DRILL, REAM, COUNTERSINK, COUNTERBORE on the same drill press! No need to set up for each operation. A simple rotation of this turret head brings any of 4 drills or cutting tools into position. Speeds production—cuts cost!

NOW!

quindrill

(5 POSITION)
(TURRET HEAD)



All the easy-operation features of the Quadrill... plus an extra spindle!

FOR FAST, ACCURATE TAPPING—
USE THE **quadtapper**

Fits any spindle on the Quadrill and Quindrill only.

CHICAGO QUADRILL
Company

1852 BUSSE HIGHWAY • DES PLAINES, ILL.

WRITE TODAY
FOR COMPLETE
INFORMATION

USE READER SERVICE CARD, CIRCLE 133

HOGGSON BRAND

Les-Strain

rounded face
steel
stamps



MARK but don't **MAR!**

Order from this handy chart:

Gothic style	size (inches)
A	1/16
A	3/32
A	1/8
A	5/32
A	3/16
A	1/4
A	3/8

On all the new lightweight metals HOGGSON BRAND Les-Strain steel stamps are the safest means of permanent identification . . .

fracture is held to an absolute minimum rounded faces of the character indent, but do not cut or crack the metal under normal use

HOGGSON BRAND Les-Strain stamps are:

manufactured of high strength alloy steel designed with chamfered front edges to assure correct position for marking available from stock in sizes shown, in sets of 27 letters and 9 numerals, packed in sturdy wood compartment boxes.

Insist on HOGGSON BRAND for the finest marking stamps. See your distributor. Send for our catalog!

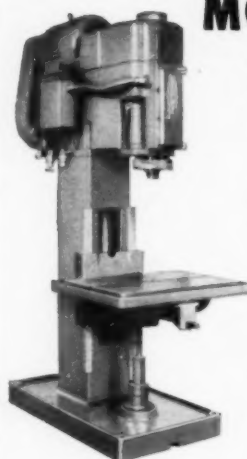
HOGGSON & PETTIS MANUFACTURING CO.
141 Brewery St., New Haven, Conn.

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FOR HIGH SPEED PRECISION
TAPPING CHOOSE THE

KAUFMAN

MODEL 10E-20



Check these six features of this new, precision-built Kaufman Tapping Machine:

1. Lead screw control for accurate threads and maximum tool life. Maximum $4\frac{1}{2}$ " lead screw travel.
2. Rapid approach of spindles to work.
3. Clutch operated for faster operation — Reversing spindles at twice forward speed.
4. Six speed transmission providing spindle speeds of 80-350 RPM with 3-1 ratio or 160-700 with $1\frac{1}{2}$ -1 ratio clutch.
5. Units provided with 5-7 $\frac{1}{2}$ -10 H.P. motors.
6. Speeds and H.P. available for highly efficient tapping from $5/16$ " through 2" NC taps or smaller taps with use of multiple head.

For additional information about the new Model 10E-20 or other Kaufman machines for single or multiple operation, write or telephone:

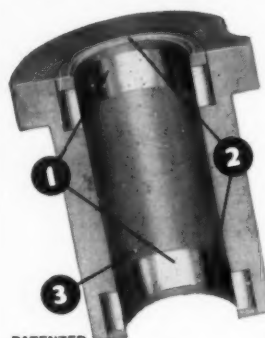


KAUFMAN MFG. CO.

553 S. 29th Street. Manitowoc, Wisconsin
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Does the Job of Solid Carbide

...COSTS LESS!



PATENTED

1. Tungsten carbide rings at the points of wear; 2. Steel rings protect drills and carbide; 3. Special hardened alloy steel body.

longer; saves man-hours and machine down-time! All this spells high production at a lower cost. For over a decade, carbide inserted drill jig bushings have been saving money on long production runs for cost conscious customers.

Write for full details—
ask for new Bushing Catalog No. 42

W. F. MEYERS CO., INC., BEDFORD, IND.

USE READER SERVICE CARD, CIRCLE 136

The Tool Engineer

NOW THE WORLD'S GREATEST VALUE IN A COPYING LATHE.

THE CLEARING-HARRISON

Just \$37500*



*Base Price F.O.B. Chicago,
Los Angeles, New York.

* 11" Copying model—\$3,750.00†
Standard 11" model—\$1,950.00

Here are copying lathes at prices you would normally expect to pay for a standard machine! Yet the Clearing-Harrison is a world beater of a lathe—carefully designed and as rugged as they come.

Check These Features!

Standard Duty—Copying mechanism doesn't interfere with the use of the lathe for standard operations.

Induction Hardened Bed Ways—Ways are hardened and ground by Delapena equipment—virtually exclusive with the Clearing-Harrison

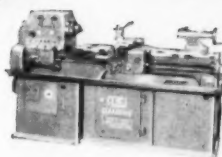
Precision hardened gears

Anti-Friction Bearings to the Spindle

FIND OUT MORE ABOUT THE COPYING LATHE YOU CAN OWN FOR WHAT YOU'D EXPECT TO PAY FOR A STANDARD MACHINE. WRITE CLEARING TODAY!

Clearing, division of U. S. Industries, Inc. also manufactures the Clearing-Axelson line of engine lathes, power presses of all types, dies and special tooling and special equipment for the aircraft and missiles industry.

Write for Clearing-Harrison catalog



13" Copying model—\$4,850.00†

13" Standard model—\$2,950.00†



16" Copying model—\$6,950.00†

16" Standard model—\$4,450.00†

Coast to Coast Service Facilities

Clearing's nationwide facilities assure you of prompt service always. Replacement parts and accessories are stocked at Clearing and are available through all three plants, at all service centers and through all Clearing dealers.



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DIVISION OF U. S. INDUSTRIES, INC.

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Plants in: Chicago, Ill. • Hamilton, Ohio • Los Angeles, Calif.

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A PRODUCT

OF SKILL



BUTTERFIELD

**100%
INSPECTED
TOOLS**

the complete line

You can get Butterfield quality-produced reamers, drills, taps, dies, counterbores, cutters, end mills, hobs and carbide tools in quantity when and where you want them. Warehouses in Chicago, Cleveland, Detroit, Fort Worth, Los Angeles, New York and San Francisco.

Call your Butterfield Distributor.

BUTTERFIELD

BUTTERFIELD DIVISION,

UNION TWIST DRILL COMPANY, DERBY LINE, VERMONT

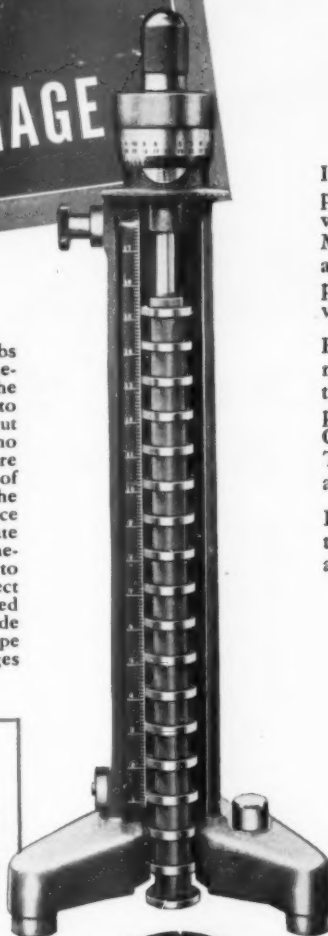
Products of Precision by CADILLAC GAGE

PLA-CHEK GAGES

In thousands of installations on innumerable jobs PLA-CHEK Gages are daily proving their time-saving and money-saving advantages, both at the surface plate and the machine. Extremely easy to operate—and fast, too,—PLA-CHEK Gages cut inspection time from minutes to seconds with no loss of accuracy. No auxiliary gage blocks are necessary. PLA-CHEK'S measuring bar is made of deep-frozen, strain-free alloy steel. Steps on the bar are exactly 1" apart. Because of its one-piece construction, steps cannot change or separate with age. Adjustment of the bar is by the micrometer thimble at top. Since it is not necessary to touch the measuring bar, body heat cannot affect it. All reference surfaces are ground and lapped to extremely close tolerances. Precision-made risers, which give PLA-CHEK even more scope and are engineered as accurately as the gages themselves, are available for all models.

COMPLETE RANGE OF SIZES

PLA-CHEK Gages are available in a full range of sizes to meet every inspection or surface plate layout requirement. Models are: The easily portable 6", 12" and 18" sizes, each guaranteed accurate throughout its entire range to .00005"; the 24" guaranteed to .0001" over its entire range; and the 36" and 48" sizes guaranteed accurate to .0001" in any 24" length or .0002" over their entire range.



If it's precision you want—guaranteed precision—you've come to the right place when you specify Cadillac Gages and Measuring Instruments. For Cadillac is a name built over the years on accuracy, precision, quality, long instrument life, value and economy.

From the famous PLA-CHEK Gages, now proved in hundreds of plants throughout industry, through the complete line of Thread Ring, Thread Plug, Cylindrical Ring, Cylindrical Plug, Pipe Thread and Concentricity Gages, neither accuracy nor quality is ever sacrificed.

If your operations require really close tolerances, specify Cadillac Gages . . . and get guaranteed accuracy.



CYLINDRICAL RING GAGES

Deep frozen for stability and long life, Cadillac Cylindrical Ring Gages reproduce assembly conditions exactly.



THREAD PLUG GAGES

Full length of gaging member is available for inspection. Worn or damaged end may be reversed in collet. Available in a full range of sizes.



THREAD RING GAGES

Manufactured of the finest alloy steel, these gages are heat and cold-treated for maximum stability. They are carefully lapped and closely inspected under controlled conditions.



CYLINDRICAL PLUG GAGES

Available in a full range of sizes, these cylindrical plug gages provide unconditionally guaranteed accuracy.

Cadillac

GAGE COMPANY

P. O. BOX 3806 • DETROIT 5, MICHIGAN



A "Squirt" Welder welds heavy plate in 1/4 the time.

WAR AGAINST HIGH COSTS NETS BARGE BUILDER 75% BONUS

The Wiley Manufacturing Company of Fort Deposit, Maryland, builder of welded barges and large custom built cranes, initiated a cost reduction program that resulted in real savings.

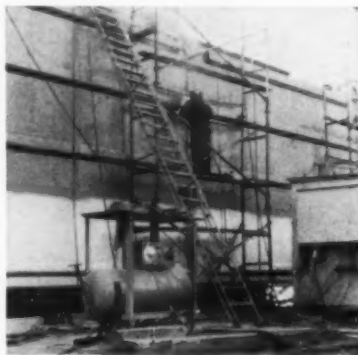
Stanley Welsh, general superintendent, and J. J. Evans, general foreman, faced with ever rising labor costs, decided bold action was necessary if the company was to keep prices competitive. Since welding is the largest single operation in the Wiley yards it was only logical that they should look for a way to reduce welding costs first.

Enlisting the aid of Joe Gulley, a Lincoln welding engineer out of Lincoln's Baltimore office, the Wiley men began a detailed survey of their welding procedures and processes.

Mr. Gulley assisted Mr. Evans and his weldors to analyze the

methods and electrodes used for welding sub-assemblies and for joining the sub-assemblies to the main structure. It was found that by positioning the smaller units iron-powder Jetweld electrodes could be used and speed increased considerably.

The jack-pot, though, was won by switching to semi-automatic



Welded units form the barge on the ways.



Structural members are fabricated on the ground with Jetweld, then welded into sub-assemblies.



Jack Evans, General Foreman at Wiley, sparked a cost reduction program that succeeded.

for welding of heavy plate. By using a Lincoln "Squirt" welder propelled on a gas cutting buggy, Wiley is able to weld heavy plate, up to 3/4 inch, in 1/4 the arc time previously required to weld it manually.

Mr. Evans states that these savings are made even greater because very little plate preparation is necessary. Bevel is eliminated in plate up to 1/2" and weld cleaning is greatly simplified. The resulting welds are better, too, than can be made manually.

The result—a 75% saving in arc time on this operation!

Although no overall cost figures were immediately available, Mr. Evans estimated that they had been able to reduce total welding costs by at least one third.

*The World's Largest Manufacturer
of Arc Welding Equipment*



THE LINCOLN ELECTRIC COMPANY • DEPT. 5027 • CLEVELAND 17, OHIO



*Lapped For
Maximum
Wear Life,
Maximum Quality*

PIPE MACHINERY THREAD GAGES

As a precious stone is carefully cut and polished by an expert jeweler—so every Pipe Machinery thread gage is painstakingly lapped by experienced craftsmen to remove soft grinding skin, fat end threads and to produce a low micro finish.

Modern inspection facilities assure rigid operator control during every step of this important lapping process . . . assure a finished product of uniformly high quality with built-in wear life second to none.

When you purchase a Pipe Machinery thread gage, you can be certain the best in material, the best in equipment and the best in human skill have gone into its manufacture.

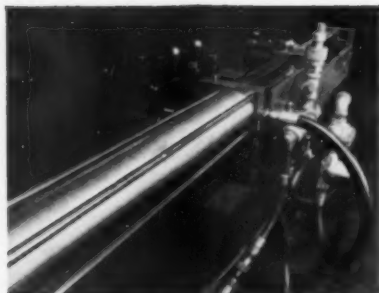
Write today for further information on our complete line of gages.

THE PIPE MACHINERY COMPANY • 29100 Lakeland Boulevard • Wickliffe, Ohio • Greater Cleveland

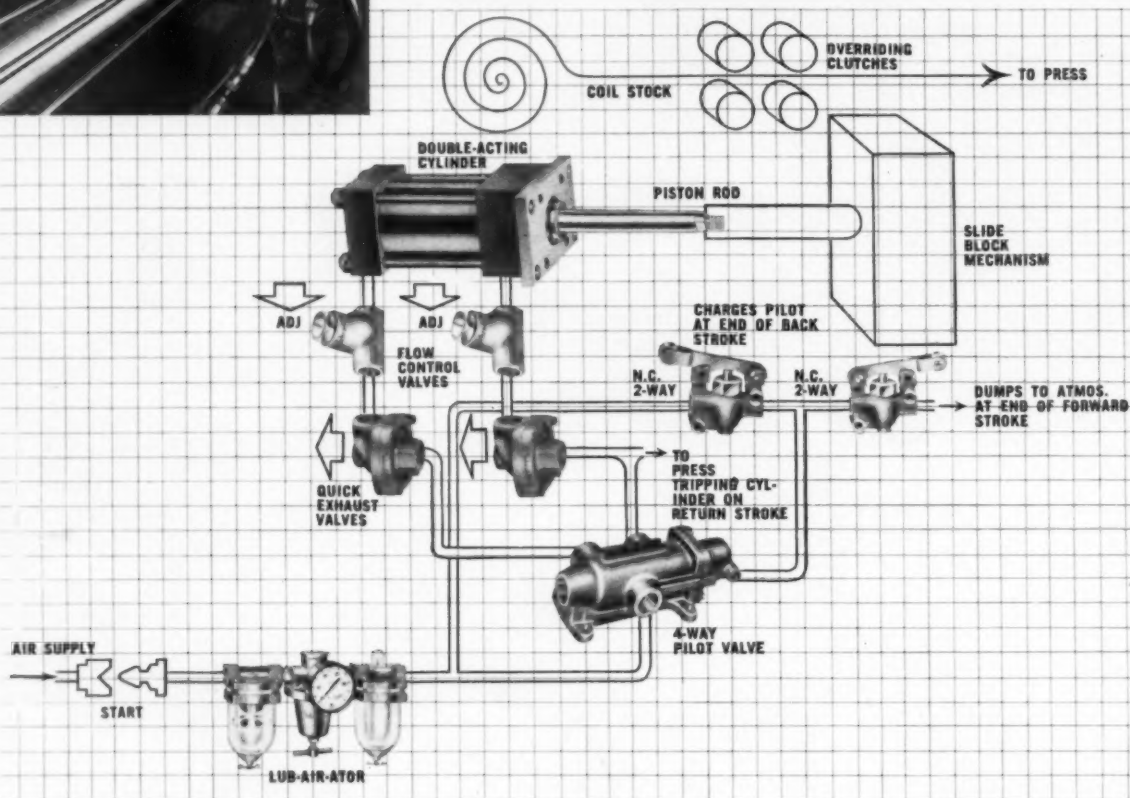
September 1959

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227



This is an example of how OEM use Schrader. The hookup of Schrader Air Products in the large schematic is used by the Cooper-Weymouth Company of Stratford, Connecticut, to operate its patented power press slide-feed. Power to the mechanism is supplied by a Schrader double-acting cylinder, the front head of which is machined as an integral part of the overriding clutch. At the end of the forward stroke, the slide block operates a normally-closed 2-way valve, which dumps the pilot of a 4-way control valve. This reverses cylinder piston, and the slide block mounted on it, to return for the next stroke. Another normally-closed 2-way valve ahead of the pilot charges the 4-way pilot in a conventional reciprocating motion arrangement to start the next cycle.



ORIGINAL EQUIPMENT MANUFACTURER BUILDS STANDARD SCHRADER AIR PRODUCTS INTO AUTOMATIC TOOLS FOR SPEED, PRECISION

If your company *manufactures* machines or equipment that must push, pull, hold, position or move work repetitively . . . consider the advantages of actuating them with air. Schrader makes complete lines of Air Products that can do such jobs with dependable precision. In limitless combinations, they adapt to many special needs.

Air offers manufacturers much more than versatility. It's

fast and accurate, can time to fractions of seconds at high speeds. Its economy alone is a powerful sales point. Safe, tireless, air power is simple that problems of weight, assembly, production and maintenance are enormously reduced.

These are benefits all customers look for. Add them to your products by actuating with Schrader . . . finest, most complete lines of Air Cylinders, Valves and Accessories.

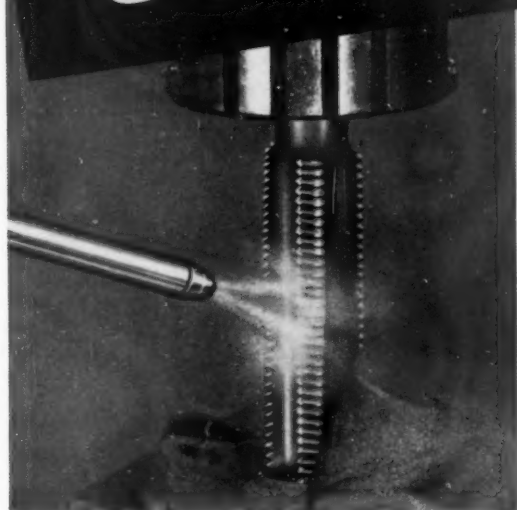
Select from the full Schrader lines to plan your automation of machines. Your Schrader distributor can help you pinpoint what you need. For more data write:



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Division of Scovill Manufacturing Company, Incorporated
462 Vanderbilt Avenue, Brooklyn 38, N. Y.

QUALITY AIR CONTROL PRODUCTS

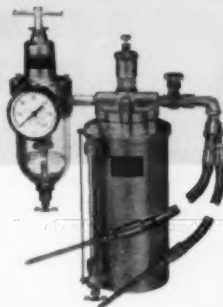
**CUT
METAL WORKING
COSTS**



...with
Norgren
**SPRAY-
LUBE** **UNITS**

for single or dual point applications on tapping, drilling, milling, and grinding operations.

- * LESS MACHINE DOWN-TIME
- * INCREASED TOOL LIFE
- * BETTER FINISHES



Lubrication Exactly Where Needed

Norgren Spray-Lube applies a fine spray of coolant directly to the tool or cutting area—at the location that provides the most efficient lubrication and cooling action.

Faster Cooling Speeds Production

A few ounces of sprayed coolant extracts more heat from the tool than gallons of the same fluid flooded over the workpiece and tool. Cutting, tapping, and grinding can be faster—output is increased—tool maintenance costs are reduced.

Reduced Coolant Consumption

With fine spray, less coolant does a better job of cooling and lubricating—cuts costs.

Better Working Conditions

No messy pools of liquid on machine or floor. Unobstructed view of work. No splashing of liquid. Machine easier to clean. Machined parts cleaner to handle.

If it's Norgren... It's Dependable.

For complete information about Norgren SPRAY-LUBE, call the nearby Norgren Representative listed in your telephone directory — or WRITE FACTORY FOR COMPLETE INFORMATION.

C.A. NORGREN CO.

3447 SOUTH ELATI STREET

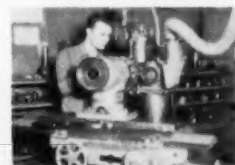
ENGLEWOOD, COLORADO



A Norgren Spray Lube System eliminates fusion of aluminum chips to milling cutter.



Norgren Spray Lube System delivers a fine, cooling spray that reduces wheel wear. Permits full view of workpiece.



Installation of Norgren Spray Lube System ended cracking of carbide-tipped cutters during sharpening—diamond wheels last twice as long.

A Division of INFILCO Inc., leaders
in liquid treating equipment,
GALE SEPARATOR Co. OFFERS YOU

Useful

INFORMATION ABOUT

* Cleaning & Filtration of
Coolants, Cutting Oils
& Industrial Liquids.

* Separation of Free
Oils from water.

Clip and send in the following:

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Please furnish information and
answers to the following problems.

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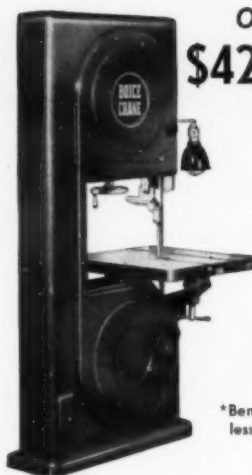
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patterns. Serves for all multi-purpose operations performed by machines
costing upwards of \$1500.00. Continuous cutting with no backstroke.
Slices away hard alloys and carbon steels the easy way!



Only
\$429.90*

*Bench model
less motor.

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making Dies and
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Popular package is
8-oz. can fitted with
Bakelite cap holding
soft-hair brush for ap-
plying right at bench;
metal surface ready for
layout in a few minutes.
The dark blue background
makes the scribed lines
show up in sharp relief,
prevents metal glare. In-
creases efficiency and
accuracy.

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on company letterhead

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STOCK TOOLS—SPECIALS
For all operations



Makers of Fine Tools Since 1868

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The Tool Engineer

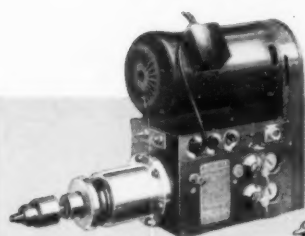
Get Low Cost Automatic Drilling and Tapping

with these versatile

DUMORE[®] UNITS

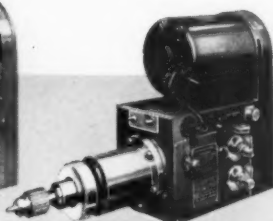
do all these operations—and more
TAP • DRILL • REAM • CHAMFER
SPOT-FACE • CENTER • DEBURR

PLUG THEM IN AND THEY'RE READY TO GO—Any unskilled laborer can learn to operate them in minutes. Once set, they're always set—minimizes scrap loss, drill breakage, and eliminates slowdowns due to operator fatigue. Change is easy and quick from job to job, operation to operation, for long or short production runs. Precision engineering, famous Dumore quality workmanship and separate, isolated hydraulic and pneumatic systems provide trouble-free service over millions of cycles. Use less air than a small hand tool. One cu. ft. of compressed air provides up to 350 strokes 3" long . . . a real cost-cutting feature.



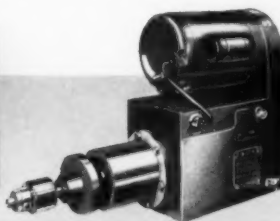
SERIES 28

Drills or taps at the flip of a selection switch. Tap fits into chuck, no extra attachments required. Reversing motor controls tap, eliminates troublesome clutches. Spindle speeds from 265 to 4900 rpm. For long or short runs.



SERIES 24

Fully automatic with all controls built-in for long or short runs and frequent changeovers.



SERIES 26

Identical in size and capacity to Series 24 with just basic controls built-in for long, uninterrupted runs.



SERIES 20

For high production drilling of small parts. Automatic built-in controls. Sets its own feeds and speeds by resistance of material to drill. No. 60 to 5/32" drill capacity.

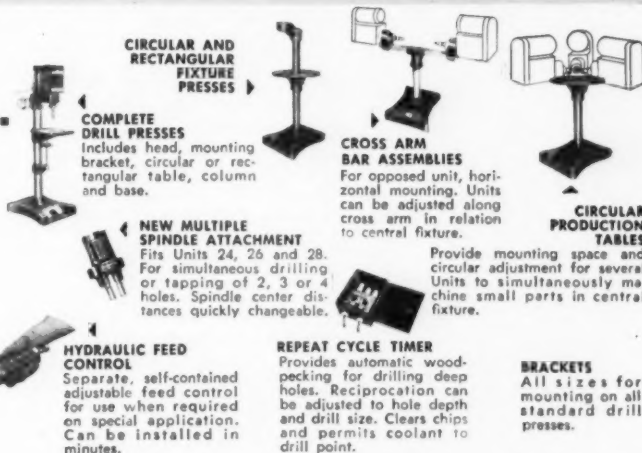
NOSE
MOUNTING
BRACKET



YOUR KEY to all-purpose machining—anywhere. It permits fast, easy mounting in any position, angle, or direction in single or multiple unit set-ups. Changeovers to other operations, when required, are made quickly, speedily. Return to original set-up is equally fast.

and these building-block accessories...

. . . let you use any Dumore Drill Unit where you can make the most of its versatile capacity. On drill press columns for single or multiple spindle applications; or added to single or multi-purpose production set-ups, transfer machines and other automatic systems. By combining several units, many machining operations on parts can be achieved in one set-up.



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NEW 2-WAY TRIGGER RELEASE

Model 462 illustrates how only one hand easily releases clamp by pressing trigger toward either handle.

This patented feature available on many De-Sta-Co Portables.

IF YOU CAN REACH IT— A Portable Will Clamp It!

Hundreds—yes, thousands—of awkward clamping problems have been brought to us for solution in our 40 years of leadership. Many of these have been solved by De-Sta-Co Portable Clamps. You now have a selection of two dozen basic models, a variety which masters almost any conceivable portable, blind or awkward clamping operation. To add to the versatility of all our portables, there's a complete line of accessories. Features which may aid you in your next problem are

1. Two way trigger releases on numerous models
2. Deep jaws and wide spans
3. Flexi-matic and Pressure-matic spindle adjustments
4. Non-magnetic materials for the special application
5. Light weight models for continuous frequent handling

De-Sta-Co Portables lend themselves to special adaptations for that "insurmountable" problem.

Standard portables offer jaw openings $\frac{1}{2}$ " to 6", throat depths to $3\frac{1}{2}$ ", pressures from 35 lb. to 1200 lb.

Send for the De-Sta-Co catalog with details on over 130 types, sizes and models of portable and fixture clamps. We'll send you the name of our stocking distributor in your area. He is ready and qualified to assist you with your clamping problem.



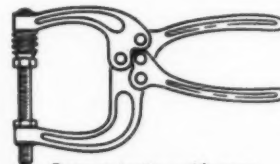
Compact models



Self-adjusting models



Deep jaw models



Pressure-matic—wide span

De-Sta-Co is widely known for toggle clamps, stampings, precision washers, spacers, shims, shim and feeler stock, blower housings and marine specialties.



DETROIT STAMPING COMPANY

328 MIDLAND AVENUE

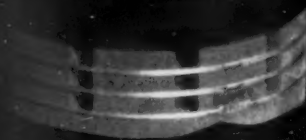
DETROIT 3, MICHIGAN

For best results
in Surface Grinding . . .
Always Use Blanchard Wheels!

The flexibility in application of your Blanchard Surface Grinder enables you to attain peak production at lowest cost on hundreds of different grinding jobs. *But, it is very important that you use the right wheel for each job!*

Blanchard makes and stocks a great variety of silicate, resinoid and vitrified bonded wheels and segments. Ask your Blanchard representative to help you select the wheel — or wheels — best suited to your requirements. Call or write him today. And may we send you a copy of "The Art of Blanchard Surface Grinding" (4th Edition)?

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CAST IRON HAND KNOBS
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QUARTER TURN SCREWS
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TOGGLE SHOE CLAMPS & V-PADS

HOLD DOWN AND CLAMPING TOOLS
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THIS HIGH PRECISION INSTRUMENT IS AN INEXPENSIVE, ACCURATE AND DEPENDABLE

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Small Bore Gages
RANGE .040" to .140" PRICE \$126.00
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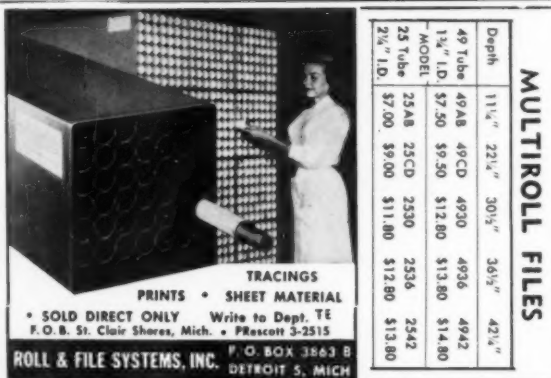
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1 1/4" I.D.	\$7.50 \$9.50 \$12.80 \$13.80 \$14.80
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ROLL & FILE SYSTEMS, INC.

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TIME EXPOSURE COMPARISON



Old stack-rod set up requires two hands. Uses up valuable production time.



New ROL-PAK set up is far simpler and quicker; requires only one hand.

New Truarc ROL-PAK speeds ring assembly, handling

ROL-PAK® is a new method of pre-stacking retaining rings for faster, more economical assembly on production lines. Pre-stacked on a color-coded tape, the rings are quickly identified by type and size. Available to users of Truarc Retaining Rings exclusively, ROL-PAK provides production flexibility, and allows faster and more efficient assembly set-up.

On your production line, ROL-PAK slips over the dispenser rail ready to use. The pressure sensitive tape is stripped off in seconds. With the old stack-rod packaging, by contrast, an operator had to remove the cotter pin, hold the bottom rings on the rod to prevent their slipping off then carefully position the rod on the dispenser rail . . . a much more time consuming, less-efficient method.

Here are important ROL-PAK advantages for you to consider: *Faster assembly* because of quicker, easier loading as illustrated above. *Easier identification* of ring size and type, right on the printed, color-coded tapes. *Greater flexibility* since all or part of ROL-PAK may be used. *Easier handling, storage* with no protruding stack-rods.

ROL-PAK is available in Truarc Series 5103 Crescent®

rings, 5133 E-rings and 5144 Reinforced E-rings in most widely used sizes. All present types of Truarc ring dispensers may be easily converted to ROL-PAK.

The design advantages of Truarc retaining rings, have led to their ever increasing use in production of products of all kinds. The new Waldes Truarc Assembly Tool Catalog AT 10-58 covering assembly tools, pliers, applicators, dispensers and grooving tools belongs in your files—write for it. And on special application problems, Waldes Truarc engineers will be glad to help. Waldes Kohinoor, Inc., 47-16 Austel Place, Long Island City 1, N. Y.

*Pat. Pending ©1959 WALDES KOHINOOR, INC.

D. 10

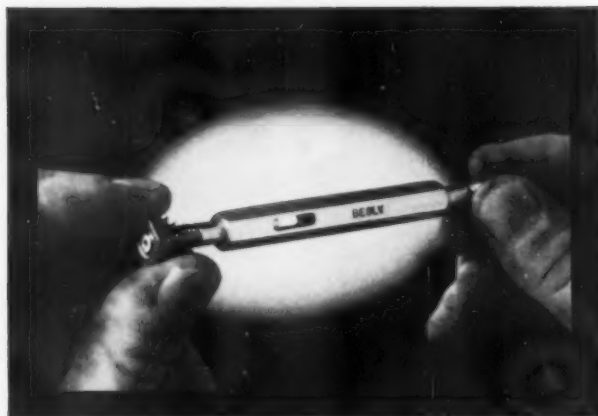


**WALDES
TRUARC®
RETAINING RINGS**

Waldes Kohinoor, Inc., Long Island City 1, N. Y.

TRUARC RETAINING RINGS...THE ENGINEERED FASTENING METHOD FOR REDUCING MATERIAL, MACHINING AND ASSEMBLY COSTS

New
Besly CP-75
 precision gages
 last 3-5 times longer



Now you can have Besly Precision Gages in *extra hard* chrome plate. Made to tolerances according to U. S. Bureau of Standards specifications, Besly CP-75 precision gages last from three to five times longer than ordinary steel gages. They give you more piece parts per gage, less downtime for gage inspections, lower gage inventory, and will not chip or peel. See your distributor, or *write us today for catalog giving complete information on our full line and prompt service.*



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FORD PRECISION TOOLS CUT BETTER, FASTER. Long-run production economy begins with H.S.S. and Solid Carbide Ford tools. Cutting edges stay sharp longer. Resharpener time and costs are reduced. Part reject rate is cut.

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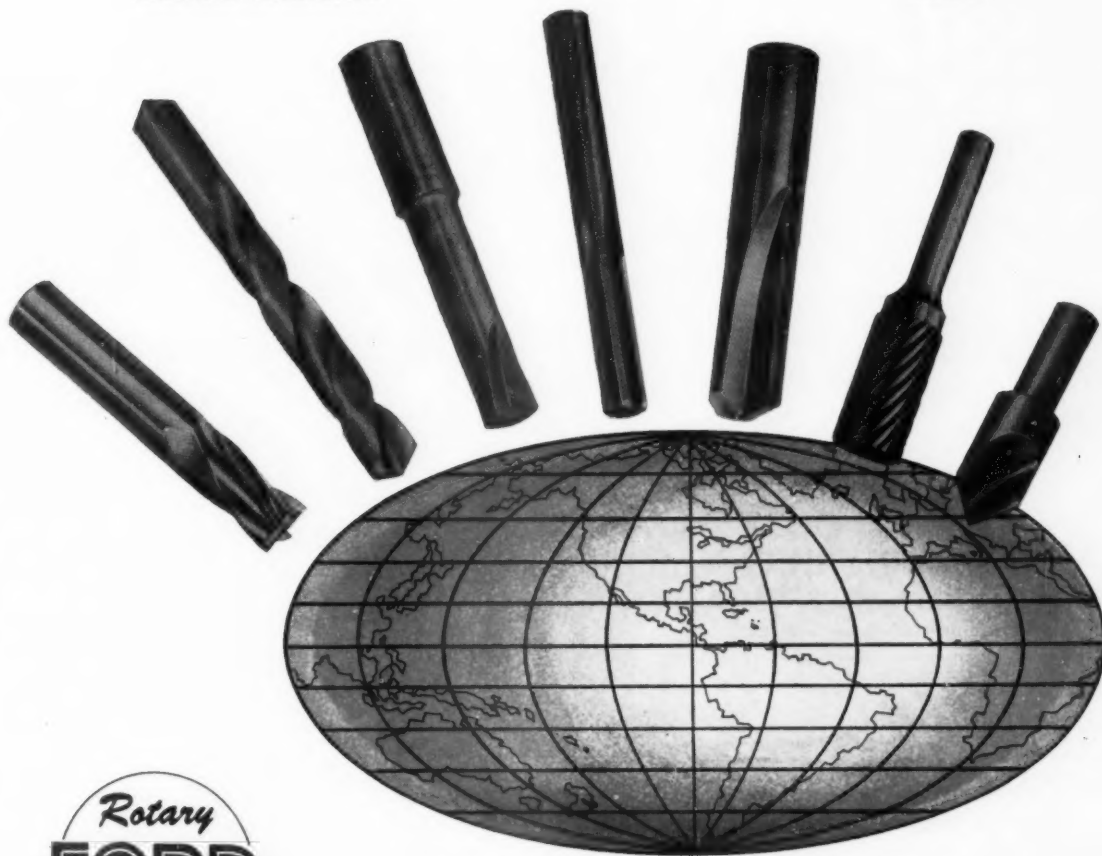
Factual testimonials on file verify the lasting dollar-saving advantages of the Ford line of tools. Available through Ford industrial distributors.

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Manufacturers of Precision Machine Tools

MUCH MORE—for LESS!

with *Cleveland* ROUGHNESS METER

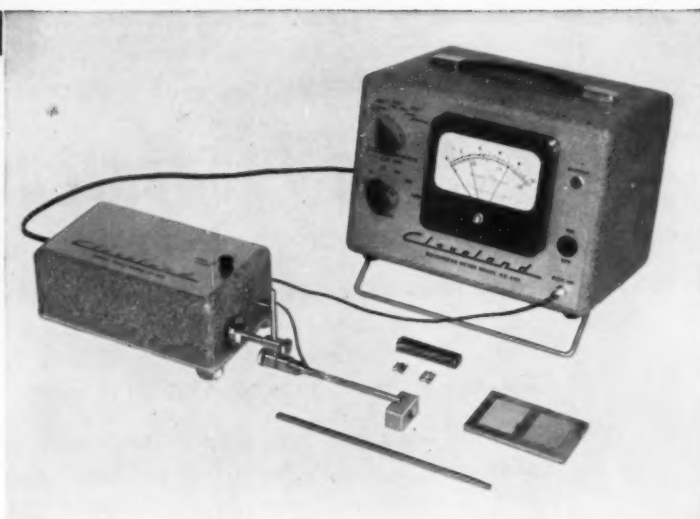
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(Made to American Gage Design Standards)

Here's the latest modern, quick, and most inexpensive way to make top quality plug gages.

It's as easy as one, two, three. One: select already hardened Tool Steel Gage Blank closest to your finished dimension. Two: select corresponding Gage Handle. Three: grind and lap to tolerance. It's as simple as that. Each part is absolutely guaranteed to meet the most rigid American Gage Design Standards.

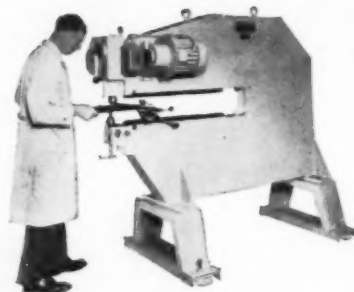
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Now you can do all this work on one machine—save time, labor and material as well as expensive die costs. Cuts mild steel up to 13/32". 8 sizes of machines to choose from.

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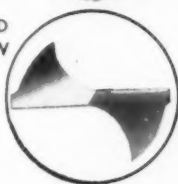
The Tool Engineer

FIRST TIME EVER!

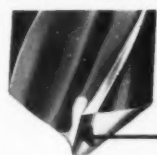
CONVENTIONAL TWIST DRILL

frequently produces
long, stringy,
unmanageable
chips

END
VIEW



"LO-TORK"



CHIPS CURL
AND BREAK
INTO SMALL
PIECES AS THEY
CONTACT
"LO-TORK" CHIP
BREAKER GRIND

PATENT APPLIED FOR

END VIEW



Unretouched photos (above) . . . dramatic proof of Chicago-Latrobe "LO-TORK" Drill's chip breaking effectiveness. Conventional drill at left; "LO-TORK" at right. Same workpiece in each photo.

a chip breaking
drill that actually
improves cutting action
— lengthens tool life!

CHICAGO-LATROBE "LO-TORK" CHIP BREAKER DRILL

Study the tips on the two drills shown above and you will understand how "LO-TORK" Chip Breaker Drills work. A new convex shape has been engineered into the flutes. Chips meet this shoulder and are reduced instantly to manageable size without sacrificing any of the efficiency of the tool's point. At the same time the tool produces extra benefits as follows:

1. Improved lubrication at drill point.
2. Uninterrupted deep hole drilling.
3. Faster feeds. 4. Longer tool life.
5. New safety for operators.
6. Quick, easy regrinds. 7. Less power required.
8. Improved plant housekeeping.

"LO-TORK" is a Chicago-Latrobe exclusive, and can be supplied in any regular or special length.

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PETERBOROUGH - NEW HAMPSHIRE

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PRESIDENT

July 13, 1959

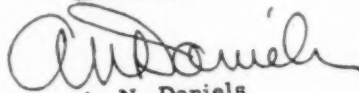
Mr. N. A. Leyds, General Manager
Bryant Chucking Grinder Company
Springfield, Vermont

Dear Mr. Leyds:

It is a pleasure to congratulate you for your Company's development of the new miniature Centalign internal grinders, from our point of view the outstanding machine tool design of the past ten years.

I feel that your engineers, designers, production people and those who made this decision are to be highly commended for this achievement.

Sincerely,



A. N. Daniels
President

AND/im

BRYANT CHUCKING GRINDER CO.
35 GILTON STREET - SPRINGFIELD, VERMONT





MOLYKOTE®

LUBRICANT

metalworking

news

PUNCH LIFE INCREASED FROM 2,000 to 25,000 HOLES IN STEEL PLATE



These punches (1 1/16") were used to punch 25,000 holes in 1/2", 1020 cold rolled steel plate. Without MOLYKOTE Lubricants a maximum life of only 2,000 holes could be obtained.

A West Coast manufacturer was experiencing low punch life with the best conventional lubricants. Their multiple punching operation consisted of cold shearing 50 holes simultaneously in a single steel plate. A maximum life of 2,000 holes per punch was obtained with ordinary lubricants.

Then, MOLYKOTE Type G was applied to the punch occasionally. The result: punch life was increased from 2,000 to 25,000 holes which afforded substantial savings.

When writing, refer to Item 508

"A LITTLE BOTTLE FOR A BIG JOB"



- For Extending Die Life.
- For Preventing Metal Pickup.

Try it . . . Order a 10 ounce container of MOLYKOTE Type Z TODAY!

When writing, refer to Item 507

MOLYKOTE CANNOT BE SQUEEZED OUT REGARDLESS OF PRESSURES; EXCELS AS COLD-FORMING LUBRICANT IN METALWORKING

Distortion, Stick-Slip and Fretting Eliminated • Mounting Loads Reduced • Chatter and Noise Avoided • Allows Easier Disassembly

In metal forming the most difficult problem to overcome is scuffing from metal pickup on the dies. Direct contact of bare surfaces of a piece undergoing formation with the die often results in galling, scuffing, etc. If the surfaces can be separated by a lubricant of sufficient film strength, metal pickup does not occur.

Before new dies are used, burnish them with MOLYKOTE Type Z. If the lubricant you are now using does not have sufficient film strength and galling does occur, use MOLYKOTE on your dies.

The automobile industry which forms and fabricates vast tonnages of various metals, uses MOLYKOTE Type Z extensively.

When writing, refer to Item 505



Applying MOLYKOTE Lubricant to feed stock at the Bassick Company, Bridgeport, Conn., in a forming operation.

DAMAGE DUE TO IMPROPER MACHINERY "WEAR-IN" CAN BE ELIMINATED WITH NEW COMPOUND

Wear-in damage is often serious enough to require costly reconditioning of new equipment and if the damage is not repaired, it will interfere with and reduce the useful service life of expensive machinery. During this critical wear-in period, damage due to galling, scoring, tearing, scratching, excessive abrasion and seizing is an inherent hazard. MOLYKOTE WEAR-IN COMPOUND is the most effective lubricant yet developed to combat this damage.

In seven different ways, MOLYKOTE WEAR-IN COMPOUND saves you time and money:

1. Shortens "wear-in" period without use of abrasives.
2. Reduces galling, seizing and excessive wear during the critical "wear-in" period in new or rebuilt machinery and after the installation of replacement parts.
3. Offers the best safeguard against costly reconditioning work and shipping delays due to the "breaking-in" of new machinery.
4. Eliminates "stick-slip" behavior and resists galling and seizing of bearing

pressures far beyond the yield point of any metal.

5. Specifically designed for "wear-in" use. MoS₂ particles make intimate contact with bearing surfaces. Will not scrape off.
6. Need not be burnished into surface. Brush or wipe on a thin coating.
7. Inexpensive . . . a little goes a long way.

When writing, refer to Item 506

Address your letter to The Alpha-Molykote Corp., 65 Harvard Ave., Stamford, Conn.
Phone: FIreside 8-3724.

THE ALPHA-MOLYKOTE CORP.

Stamford, Connecticut

Please send me details on

Item 505 ☐

Item 506 ☐

Name

Company

Address

City

State

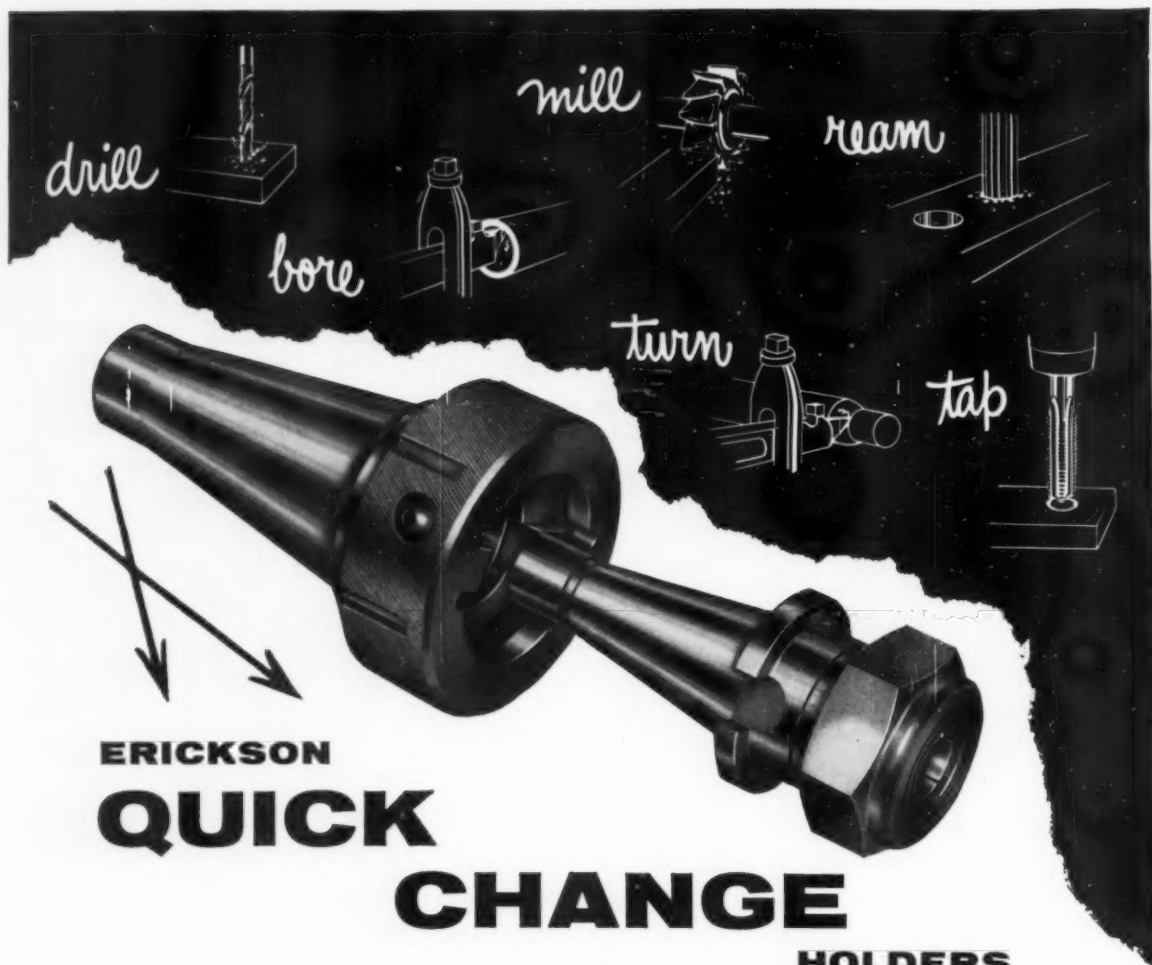
Item 507 ☐

Item 508 ☐

THE ALPHA-MOLYKOTE CORPORATION

BREAKING LUBRICATION BARRIERS

. . . THROUGH RESEARCH



ERICKSON QUICK CHANGE HOLDERS

**...for use with your standard MMS tapered tools
...designed for presetting of tools**

Now you can use your present standard MMS tapered tools with the *new* Erickson Quick Change Holders. That means you get the double production advantage of Erickson's *high precision coupled with the rapid change feature.*

Several different models comprise the line: Morse taper holders for boring mills and radial drills, milling machine holders that fit standard spindle tapers, turret lathe holders that increase turret lathe tool-holding capacity, straight shank holders with #30

AA-7455

or #40 MMS socket. These holders take Erickson Collet Chuck milling machine adapters in both regular and heavy duty types, end mill adapters, shell and face mill adapters, Morse taper adapters, boring head adapters, and chuck adapters for Jacobs internal taper.

A call or card will bring the Erickson representative on the double. Meantime write for your copy of Catalog G "Erickson Quick Change Holders."

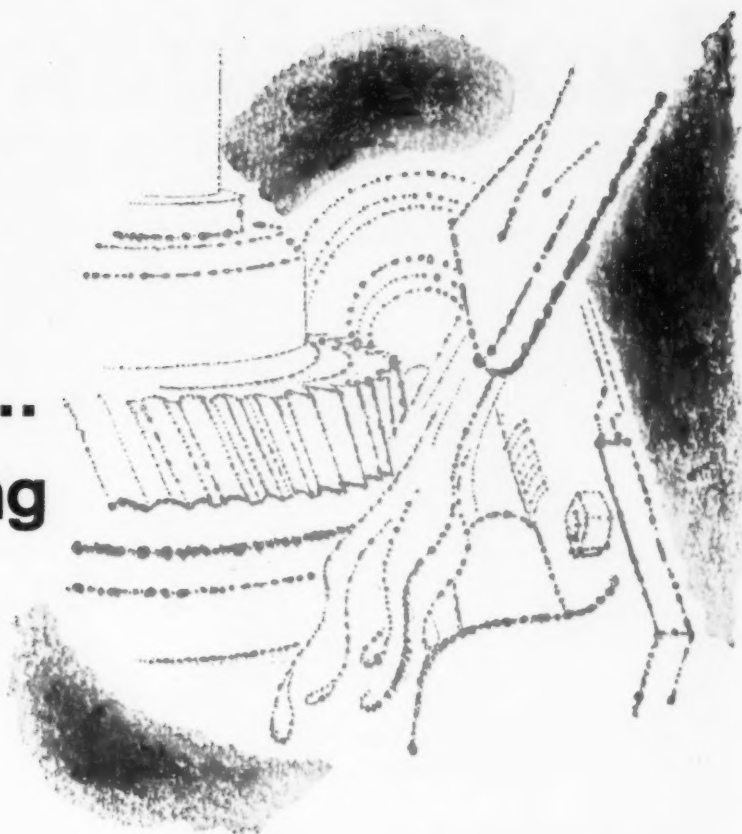


ERICKSON TOOL COMPANY

34453-9 SOLON ROAD • SOLON, OHIO

COLLET CHUCKS • FLOATING HOLDERS • TAP CHUCKS • TAP HOLDERS • AIR-OPERATED CHUCKS
EXPANDING MANDRELS • EXPANDING-COLLETS • SPECIAL HOLDING FIXTURES

Hobbing... Cutting Oils... and Reducing Rejects



Fewer rejects mean lower unit cost. For extremely tough jobs, Sinclair Ordnance heavy-duty type cutting oils have earned the reputation—in plant after plant—for increasing production by reducing rejects.

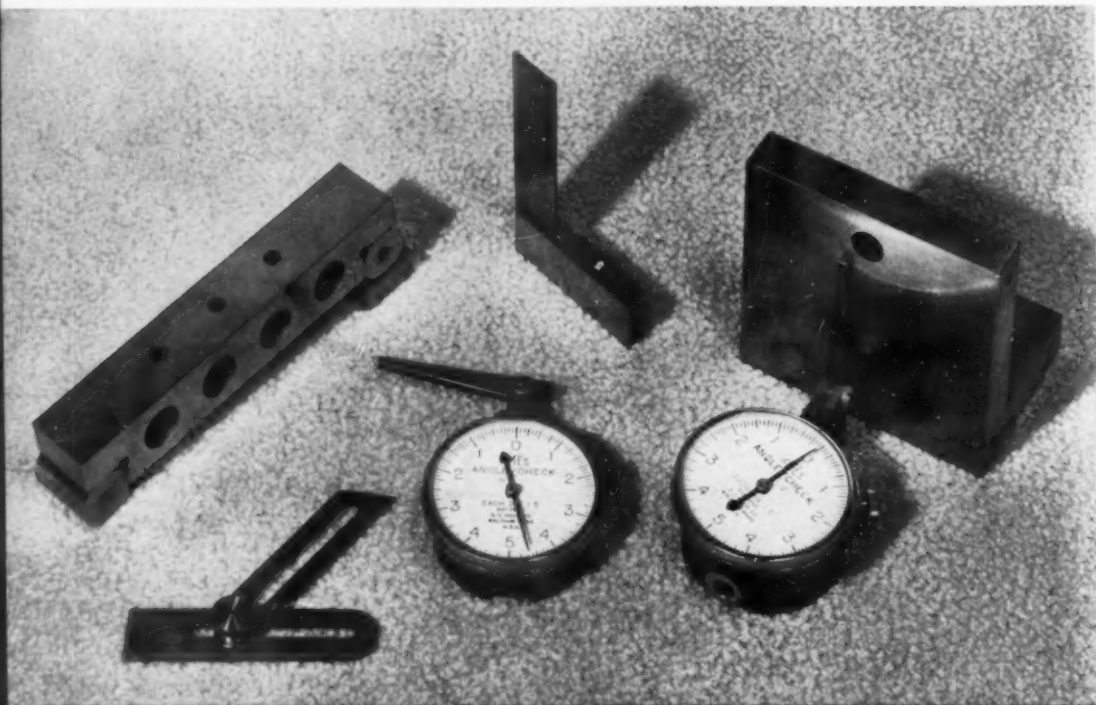
Ordnance Oils assure excellent finish, cooler parts and extended tool life. Next time you have a threading, broaching, hobbing or other difficult metal-working operation, show management how you saved money and further reduced rejects with Sinclair Ordnance Cutting Oils.

Call your Sinclair Representative for further information, or write for free literature to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. There's no obligation.



Sinclair
Ordnance Cutting Oils

Check Angles Quickly and Precisely with the New



AMES DIAL TYPE ANGLE CHECK®

ANGLE CHECK, a new dial type measuring instrument, offers you a fast, inexpensive and extremely accurate method for checking all types of angular parts.

ANGLE CHECK is available in two models: Model V for vertical work and Model H for horizontal. Either model will accommodate any AMES 200 Series back. Contact blades can be specified in various shapes and lengths to meet your exact requirements.

Built to give long, trouble-free service, ANGLE CHECK will save hours in checking predetermined angles on simple and intricate shapes. Set ANGLE CHECK to master, protractor or sine bar.

The contact blade can be set simply and quickly without tools to a predetermined angle with the dial "0" under the indicator hand. A range of 10°—from 5° minus to 5° plus—in increments of 5' can be obtained. ANGLE CHECK is accurate to 5'. Write today for complete information.

Representatives in Principal Cities



B.C. AMES CO.

30 Ames Street, Waltham 54, Mass.

Canadian Office—B. C. Ames Co., 45 Oriole Parkway, Toronto

MANUFACTURERS OF MICROMETER DIAL INDICATORS AND GAUGES

ARMATURE SHAFTS MACHINED ON AIR-FEED AUTOMATIC



The Harley-Davidson Motor Co., is well known throughout the world for its complete line of motorcycles and motor-scooters. The latest addition to their line is the new Topper motor-scooter. Advanced design and quality craftsmanship, plus wise application of modern production machines and tooling techniques, have won this company wide recognition for their products.

Many of the precision parts for these motorcycles and motor-scooters are made on the nineteen Greenlee Automatic Bar Machines shown in the photograph. An excellent example of this is the 8-15/16 inch long generator armature shaft shown in the tooling layout.

This part is machined on a standard 2"-6 Air-Feed Bar Automatic at a gross production rate of 53 pieces per hour with High Speed Steel tools. It is machined from 13/16 inch round stress-proof steel at a spindle speed of 517 rpm, producing 112 sfm on the outside diameter of the stock. A 2-7/8 inch tool slide is used with a .0051 inch feed on the endworking tools.

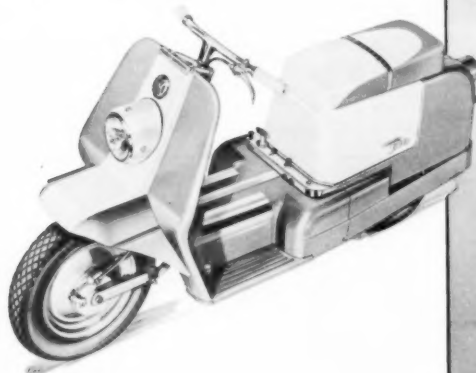
The part is fed out 9-1/8 inches in the first position against a live-center receding stock-stop. When the stock contacts the stock-stop the collet closes and the stock-stop

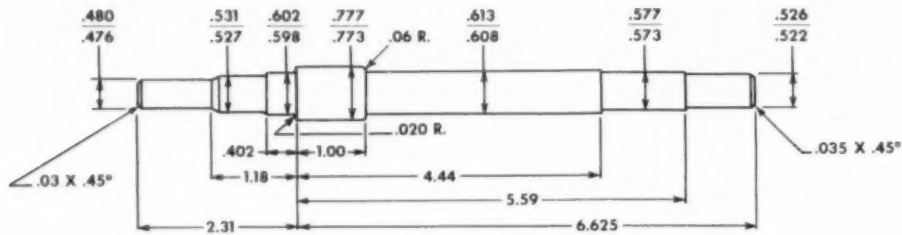
moves away from the end of the bar, permitting the stock to rotate freely and index to the next position. The movement of the stock-stop is controlled by a small air cylinder mounted on the gear box. After the stock is fed out the .773-.777 inch diameter and a small section of the .608 inch diameter is formed.

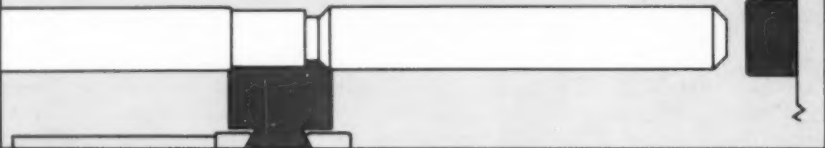
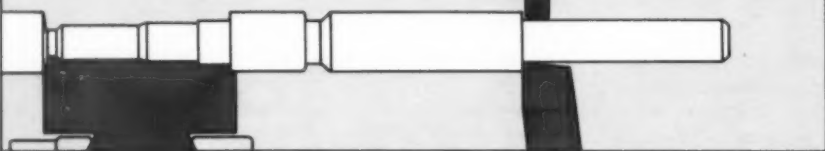

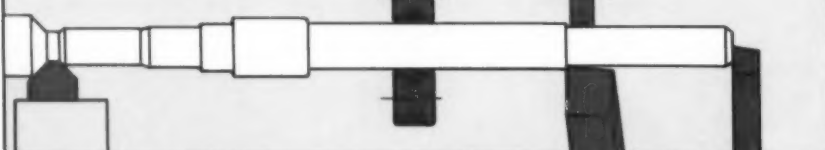

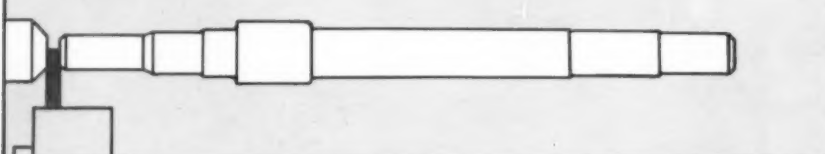
The .608 inch diameter is roller turned halfway and the backend of the part is rough formed in the second position. A three roll roller rest mounted on the tool slide in the third position supports the work piece while the remainder of the .608 inch diameter is roller turned and the backend is finish formed by a standard dovetail form tool.

In the fourth position the .573 inch diameter is roller turned and the end faced with an auxiliary turner. A flat form tool breaks down for cut-off and forms a 45° bevel on the front end of the next piece. The purpose of this bevel is to provide a better starting condition for the roller turner in the second position. The .522 inch diameter is turned with a standard roller turner and chamfered by an auxiliary turner and the .773-.777 inch diameter is finish formed in the fifth position. The machining operations in the fourth and fifth positions are supported by standard three roll roller rests. The part is cut off in the sixth position.

The Topper has a one-cylinder two-cycle engine with a fully automatic transmission. Gets up to 100 miles per gallon.





FIRST POSITION: 	1. Feed out to 9 1/4" 2. Rough form .773"- .777" and .608" diameters Cam ratio: 6:1	FEED .0051	SFM 112
SECOND POSITION: 	1. Roller turn .608" diameter half way 2. Rough form backend and breakdown for cutoff Cam ratio: 6:1	.0051 .0008	112 112
THIRD POSITION: 	1. Roller support on .608" diameter (3-roll) 2. Roller turn .608" diameter to required length 3. Finish form backend Cam ratio: 6:1	— .0051 .0008	— 112 105
FOURTH POSITION: 	1. Roller support on .608" diameter (3-roll) 2. Roller turn .573" diameter 3. Face end 4. Breakdown for cutoff and form 45° bevel on the front end of the next piece Cam ratio: 5:1	— .0051 .0051 .001	— 83 78 64
FIFTH POSITION: 	1. Roller support on .608" diameter 2. Roller turn .522" diameter 3. Turn .035" x 45° chamfer 4. Finish form .773"- .777" diameter Cam ratio: 6:1	— .0051 .0051 .0008	— 78 71 105
SIXTH POSITION: 	1. Cut off Cam ratio: 2:51	.002	56

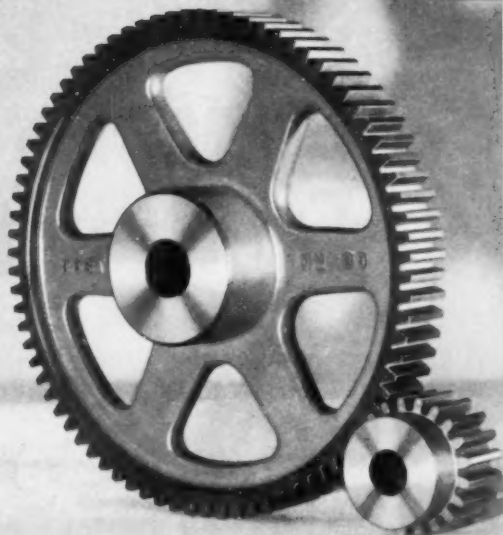
If you wish to receive AUTOMATIC NEWS regularly, write Greenlee Bros. & Co., Rockford, Ill.

14½° P.A.

pinion 2.5" P.D. gear 10"

WEIGHT
14 lbs. 15 oz.

CENTER DISTANCE
6.25"



PRICE
\$28.95

SAME RATIO

**SAVES 31%
IN WEIGHT**

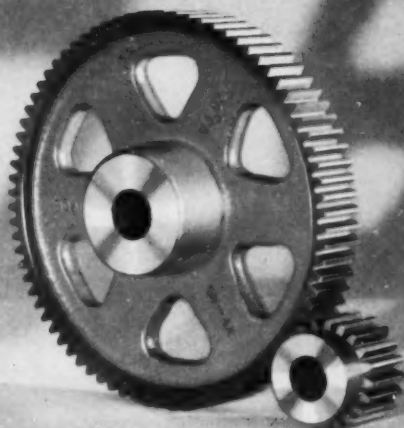
**SAVES 20%
IN SPACE**

20° P.A.

pinion 2" P.D. gear 8"

WEIGHT
10 lbs. 2 oz.

CENTER DISTANCE
5"



PRICE
\$22.09

SAVES 23.7% IN COST

Both meet the job specifications — but

one of these gear sets costs you 23% less

NOW... **567** STANDARD SIZES OF
BOSTON **20° P.A. GEARS**
FROM STOCK

SPUR Steel and Iron 20 to 4 P.
Fine Pitch Brass 64, 48, 32, and 24 P.

MITER Cast Iron 8 to 2½ P. Steel 48 to 4 P.
Fine Pitch Brass 48, 32, and 24 P.

BEVEL Steel and Iron 20 to 3 P.
Fine Pitch Brass 48, 32, and 24 P.

For complete listings
see the BOSTON GEAR
CATALOG No. 57



Every engineer knows the quiet-running efficiency and high strength of the 20° Pressure Angle tooth form. For most installations, the 20° P. A. Gear that meets specifications saves an average of 20% in space, weight, and cost over the comparable 14½° P. A. Gear required.

Now, the types and sizes of 20° P. A. Gears you need to make these big savings in your assemblies are available, anywhere in industrial U.S.A. and Canada, FROM STOCK at over 100 conveniently located BOSTON GEAR Distributors.

Your local Distributor's factory-trained gear specialist is at your service. Get details. Start making the savings you've been missing. Boston Gear Works, 83 Hayward St., Quincy, Mass.

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CALL YOUR NEARBY

BOSTON *Gear*
DISTRIBUTOR

— STANDARDIZATION PAYS —



NEW THOR AIR GRINDERS



**Safest
Grinders
Ever Built!**



THOR NO. 5 SERIES HEAVY DUTY AIR GRINDERS

Available with grip, lever or butterfly throttle, in speeds of 6000, 4500 r.p.m. for grinding, and a geared 2000 r.p.m. model for wire brush work. Equipped with new hinged guard with wing-nut release for safety and convenience of easy wheel change.



100% increase in power at no increase in weight

Put this new Thor air grinder to work and get set for real performance. You remove far more metal in far less time—and you work safely.

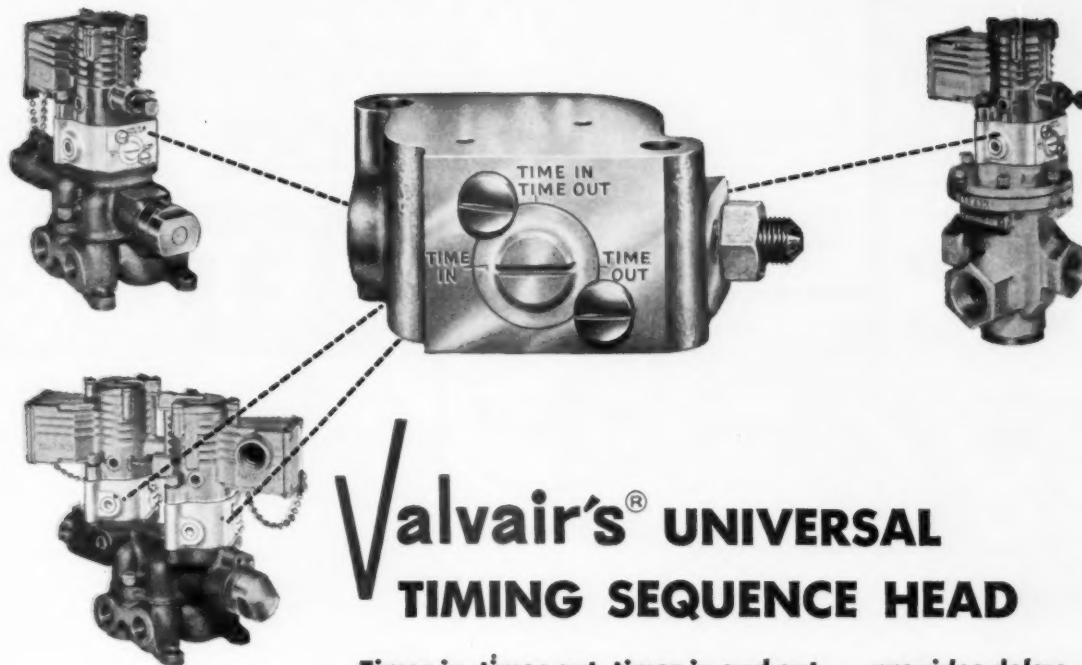
A positive safety control, in addition to the standard governor, absolutely prevents "run-away" tools. If the governor fails, the air supply is automatically cut off.

Weighing only 10 lbs. Thor's new straight grinder delivers more horsepower, more torque to the wheel. Quieter operation, too. Ask your Thor factory representative for a demonstration.

THOR POWER TOOL COMPANY

AURORA, ILLINOIS

Branches in all principal cities



Valvair's® UNIVERSAL TIMING SEQUENCE HEAD

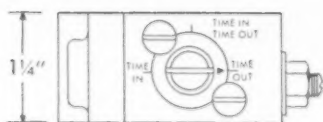
Times in, times out, times in and out . . . provides delay from 0 up to 30 seconds . . . repeatability within 2% . . . changes function without disassembly . . . for use with any Valvair Speed King or Inline Valve

For accurate control, to simplify circuits, to eliminate timers and relays, to lower control component installation and maintenance costs, use Valvair's universal timing sequence head. This unit is supplied in two types; one for direct mounting between the pilot and valve body; one for direct mounting on the valve body, with remote pilot control.

Function can be changed in seconds, *without disassembly* and with line pressure on the valve. Just loosen the lock screws slightly, turn the indicating barrel to the desired function mark, then tighten the lock screws.

A port is provided for installation of accessory reservoir capacity . . . delay can be extended up to several minutes. And, the Valvair name on this unit is your assurance of sound design, quality construction, micro-accurate performance and multi-million cycle dependability!

Find out how Valvair's sequence head can provide the results you want, at a cost saving you'll like, on the new equipment you're designing or on existing machines you're up-grading. Yes, this sequence head can be used on your present SPEED KING and INLINE valves, too. Ask your Valvair or Bellows Field Engineer for recommendations . . . they're located in over 125 major industrial cities.

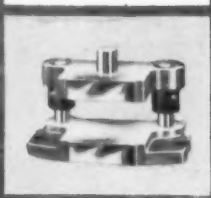
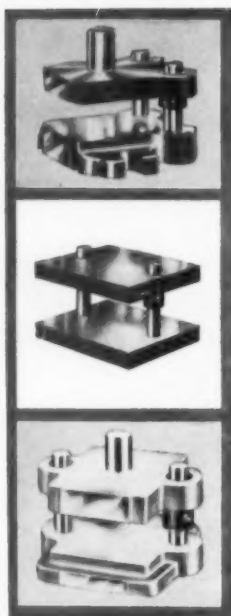


For more information, write for
Bulletin E-1A. Address Dept. TE959,
Valvair Corporation, 454 Morgan Ave.,
Akron 11, Ohio.

Valvair

AKRON 11, OHIO

Other INDUSTRIAL DIVISIONS of IBEC: The Sinclair-Collins Valve Co.
The Bellows Co., Akron, Ohio • V. D. Anderson Co., Cleveland, Ohio.



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STOCK LINE of MULTI-USE,
SOFT RUBBER BONDED ABRASIVES!

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Many new applications replacing costlier methods. *Unique action:* BURRING, FINISHING • CLEANING • POLISHING, frequently in one operation. STOCK NUMBERS for machine and manual operations, JOB-MATCHED TO YOUR REQUIREMENTS. Order from your Brightboy distributor's stock, backed up by our complete factory stock.

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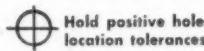
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ZIEGLER FLOATING TOOL HOLDERS INCREASE TAPPING AND REAMING PRODUCTION

FAST SET-UPS—automatically compensates for misalignment up to 1/16" on dia. between machine spindle and work.

Free-Floating, Easy-To-Use Ziegler Tool Holders permit machine operators to maintain production without scrappage due to alignment inaccuracies, eliminate bell-mouthed and oversize holes and keep job set-up costs to barest minimum.

PROMPT DELIVERY



SEND
FOR YOUR
CATALOG
TODAY



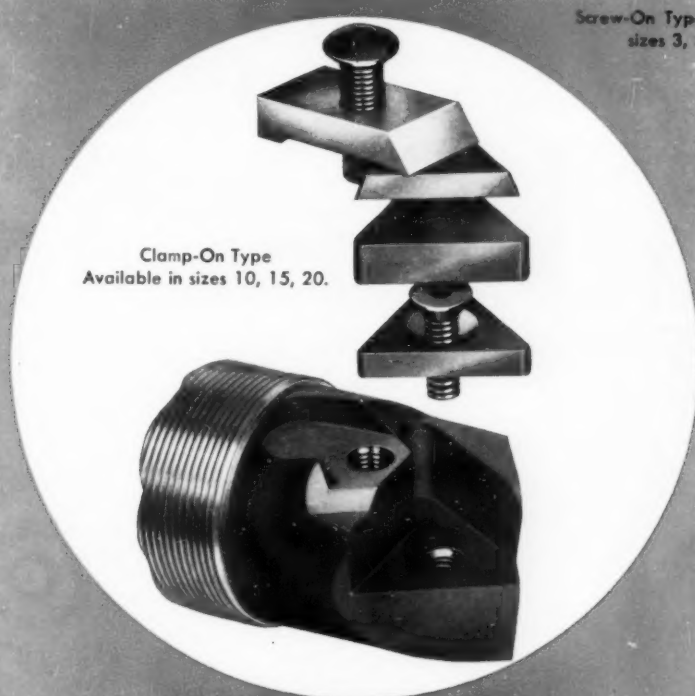
SIZES and types to fit all machines used for tapping and reaming.

W.M. ZIEGLER TOOL CO.
ROLLER DRIVE FLOATING TOOL HOLDERS 13570 Auburn
Detroit 23, Michigan

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NEW FROM FAIR STREET • HOME OF MICROBORE

Microbore[®] adjustable tooling! with Kendex[®] throw-away inserts!



Screw-On Type. Available in sizes 3, 5, 7, 10.



Accuracy! Economy! You get the best of both. Microbore, the single point cutting tool with Micrometer vernier adjustment becomes the tool holder—rigid, adjustable to precise accuracies in seconds. Kendex mechanically held throw-away inserts do the cutting. Triangular shaped, the inserts can be indexed from tip to tip. When expended, the insert is thrown away. Replacement is simple, costs far less than re-grinding. Inserts are held in place by screw-on button or clamp for fast indexing or removal. Available in sizes 3, 5, 7, 10, 15 and 20. Write for complete information on Microbore tooling with Kendex throw-away inserts, the latest development in Microbore—the complete tooling system.

DEVLIEG MICROBORE[®] SYSTEM

DEVLIEG MICROBORE • DIVISION OF DEVLIEG MACHINE COMPANY

Fair Street • Royal Oak, Michigan

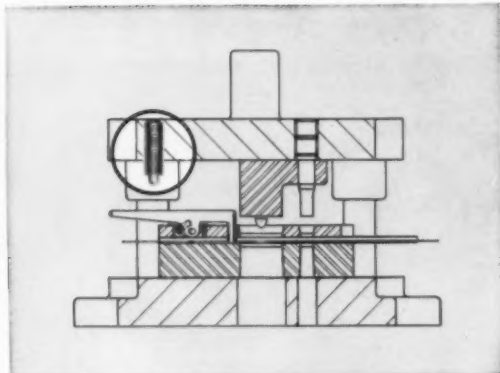
September 1959

USE READER SERVICE CARD, CIRCLE 175

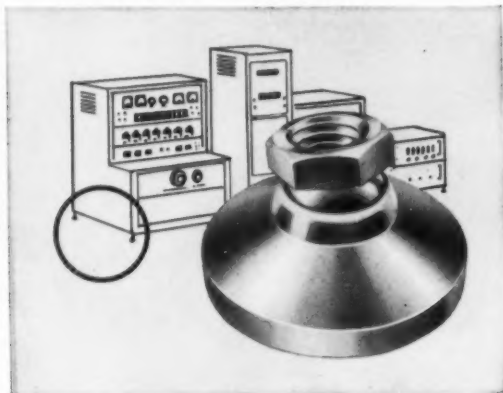
251

Practical Tooling Tips

Number 2 of a series.

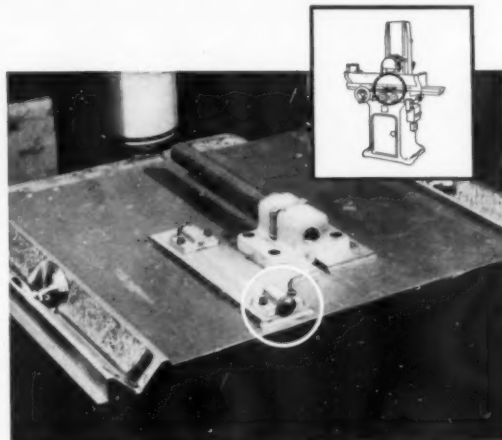


TO STOP SMASHING DIE STOPS, substitute a Vlier Spring Plunger for the usual square-head screw. The plunger actuates the automatic stop perfectly and, unlike the screw, never needs adjusting no matter how many times the die is resharpened. Available in four models: 50 sizes.



TO LEVEL MACHINE TOOLS, electronic racks, benches, etc., use the standard Vlier leveling pad. The pad swivels to $7\frac{1}{2}^\circ$ each side of the center line; adjusts automatically to uneven surfaces. Unique ball-joint design distributes weight over entire pad surface.

Substituting simple, off-the-shelf Vlier Tooling Accessories for complicated, custom-made devices in both tooling and original equipment applications can result in important savings. Why not put them to work in your plant?



TO CUSHION SHOCK as the bed traverses, this surface grinder manufacturer uses two Vlier Spring Stops, reducing wear and tear on the machine. These clever, spring-loaded devices, ordinarily used on fixtures where the absence of side walls prevents the use of spring plungers, are now available in three standard sizes: 3 end pressures. Special sizes made to quantity orders.



TO GET NEW IDEAS on how to save with Vlier Tooling Accessories, send for new 28-page booklet "Typical Applications of Vlier Tooling Accessories." It suggests dozens of ways to use these time-savers in both tooling and original equipment applications. Write for your copy today.

New catalog now ready!
Send for your copy today.



Insist on Vlier Tooling Accessories...
there's still no substitute for quality!



A subsidiary of Barry Controls, Inc.
8900 Santa Monica Blvd. • Los Angeles 46, California



announces

L-100-M

SPEED-BAND

a new concept in
band saw blades



From Capewell's famous Research and Development Laboratory comes the announcement of an important new metalworking development—Speed-Band

- ★ Speed-Band is the first band saw blade to be produced from a new alloy specifically designed for band saw blades
- ★ Speed-Band is made from a double carbide alloy formulated to deliver optimum performance by embodying those characteristics most needed for economic sawing
- ★ Speed-Band's double carbide alloy provides the hot hardness and abrasion resistance which permit use at higher speeds and feeds on standard carbon band saw machines
- ★ Speed-Band's hot hardness and abrasion resistance increases the range and types of materials which can be cut on standard carbon band saw cutoff machines
- ★ Speed-Band's hot hardness and abrasion resistance qualities guarantee faster cutting and greater productivity
- ★ Speed-Band's exclusive features greatly extend blade life, reduce blade changing and down time, and minimize tool risk.

Speed-Band is the first band saw ever to be designed and developed with the user and the end use in mind. The genuine Speed-Band is manufactured only by the Capewell Mfg. Co., and sold only through authorized Capewell Distributors.



THE CAPEWELL MFG. CO., HARTFORD 2, CONN.

Special note to buyers of capital equipment:

Speed-Band's greater potential on standard equipment can eliminate the need for expensive special machinery.

Speed-Band's increased performance potential allows standard carbon bandsaw machines to be operated to their full capability for the first time.

Speed-Band's flexibility permits its use on machines designed for high speed bands, and where applicable, can reduce tool cost substantially.

Before you buy, see your Capewell Distributor for all the details on Speed-Band, the sensible band saw.

Alice F. Murphy

—tooling expert



She helps you produce more profitably

Mrs. Murphy probably has never heard of your company—doesn't understand what you make or why. Just the same, she arbitrates your costs, sets your quality levels, determines your gross volume.

Every time she buys a washing machine, an automobile, a toaster, or a bird cage, she's determining somebody's cost-quality formula . . . somebody's tooling economics and standards.

Point is it takes more than machines, materials, and people to market a

product profitably—and a market is more important than a mill.

The engineering aspects of production are one thing—economics is another. The type of tooling used (and the way it is used) can show . . . on the very same machines, and with the same cutting tools . . . a marked difference on the profit-and-loss statement.

Only when this difference exists in the form of profits is it possible to add new features to your product and stay on the good side of Mrs. Murphy.



Costs drop when downtime is brought under control with Optimization Tooling

New tooling concepts reduce direct and indirect costs simultaneously. Any machine with cutting tools can benefit from Optimization.

Less concentration on tool life and more attention to machine downtime will reveal some simple and startling economic facts.

Machine-hour charges for tool changing and resetting are often *eight times* the cost of tool depreciation. And, the more machine spindles, the higher the cost.

Thus, it is important not only to change a tool fast when it gets dull, but to change it economically—perhaps before it gets dull. For this, you need both the tooling and the *method*.

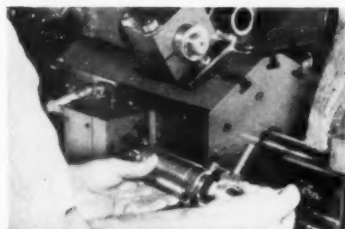
In tooling studies we have found that the age of a machine does not always tell whether its economic concepts are as sound as its engineering. It may be equipped with the most advanced cutting tools, but without tool-change methods, the real answer to cost reduction is probably *Optimization tooling*.

Scully-Jones tools have been designed for a variety of machines on which there is a tool change problem. Capital investment, tool replacement costs, and overhead have been taken into consideration. Methods and Toolitrol equipment, including presetting tools and automatic counters, increase utilization of machinery.

Some users have found this equipment so effective in reducing perishable tool costs, machine speeds have been increased at the expense of tool life, bringing cost per piece to the irreducible minimum. Examples are given below.

AUTOMATICS

748 extra parts machined in time saved for every tool change

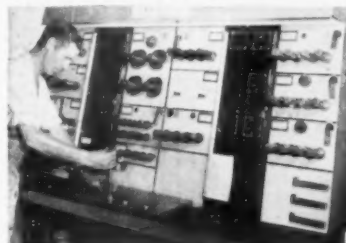


Optimization tools similar to the above reduced the time required to change 11 tools in a six-spindle automatic from 63 minutes and 40 seconds to eight minutes and 30 seconds. In 55 minutes of tool replacement time saved, the machine turns out an additional 748 parts.

Standard "Optimization" preset and quick-change toolholders are available now for most large automatics. In changing tools, the operator just twists the holder and slips it out of the machine. He replaces it with a duplicate holder in which a sharp tool has been preset for depth, using a height-setting tool. Instantly, the machine is ready to cut accurate pieceparts. There are no tool adjustments to hold up production, no cut-and-try methods of getting proper depth settings, and no cut-and-try scrap.

TRANSFER MACHINES

Save \$42,000 per week with Optimization tool change system



Here's a case where Optimization tools and programed tool changes saved big money.

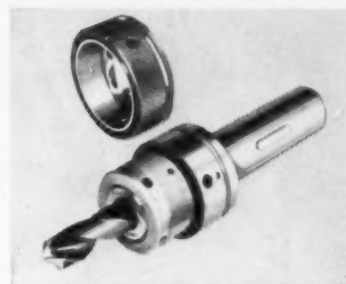
Instead of changing tools one at a time as they get dull, complete sets of tools are replaced at every shutdown period by a team of tool-setters. This minimizes total shutdown time.

Shutdowns are controlled automatically by counters in the Toolitrol board, preset in accordance with analyzed wear experience for each type of tool. Benefits of the system are: 1) reduces the number of downtimes, 2) simplifies job-setting, 3) controls tool life at economical number of pieces, 4) helps meet production schedules, 5) reduces possibility of machine

breakdowns due to overloading, 6) broadens jobsetter skills.

DRILLING MACHINES

New drill chuck combines quick-change with tool life saving



Recent tests show that stub drilling without bushings saves tools and time.

Short, rigid drills last longer, and they can be changed in 80% less time in multiple-spindle drilling heads equipped with Scully-Jones Stub-A-Long holders (above).

Reduction of wear is almost directly proportional to elimination of chatter in the stiffer, stubbed-up drills. The drill is gripped on the margins for locating and driving. The quick-change collar permits the drill and collet to be removed in one simple motion.

OPTIMIZATION Engineering Service—If your operations include the use of multiple-spindle machines and automatics, an Optimization Tooling Survey may show that substantial savings can be made as the result of a relatively low tooling expenditure. Improvements may come from reduced downtime, higher machine speeds, or both. Our engineers will gladly study your jobs and give you a complete analysis. Phone the factory—BIshop 7-5900.

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JONES**

Scully-Jones and Company
1915 So. Rockwell Street, Chicago 8, Illinois

WORLD FAMOUS

METALWORKING TOOLS

twist drills . . . milling cutters . . . taps . . . etc.

WOODWORKING TOOLS

augers . . . gimlets . . . chisels . . . gauges . . . saws . . . etc.

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caliper gauges . . . micrometers . . . snap gauges . . . etc.

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spanners and wrenches . . . vises . . . pliers . . . nippers

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glass paper . . . emery cloth . . . grinding wheels.

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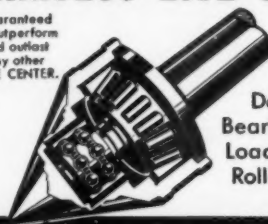
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Guaranteed
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and outlast
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The **WHOLE**
HEAD turns on
Double Row Ball
Bearings for Radial
Load and Tapered
Roller Bearings for
Thrust Load.

MARVEL TOOL & MACHINE CO.

1086 North River Road • St. Clair, Michigan

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ONE DAY DELIVERY

YOUR DIES AND STAMPINGS

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PENDING

"PAY-LES METHOD"

Payne Tool and Engineering Co.

SPRINGFIELD, OHIO

REPRESENTATIVE WANTED

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For torqueing problems **USE** the

New

"TITANTORKER"

controlled

TORQUE DRIVER

"TITANTORKER" makes controlled power torque available for a variety of torque uses—at low cost.

When desired torque is reached an audible signal is given as the internal driving balls are forced out of their sockets and overrun.

EASY ADJUSTMENT—For increased or decreased torque, "TITANTORKER" can be simply adjusted with an Allen wrench.

"TITANTORKER" can be used with any motive power except impact wrenches. Is ideal for most controlled power torque problems due to ease of adjustment and maintenance.

Available in 4 sizes in maximum torques from 75" lb. to 225' lb., with Female Adapters in driving head and Male Adapters on torque base.

Write for details and prices



World's Largest Producers Of
Stud Drivers And Pullers

TITAN TOOL CO.

44 MAIN ST., FAIRVIEW (ERIE COUNTY), PA.

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TODAY APPEARING IN THIS ISSUE OF THE TOOL

ENGINEER, USE THE HANDY READERS SERVICE

CARD ON PAGE 177.



American Society of Tool Engineers

1960 TOOL SHOW



For information :

Detroit Artillery Armory
April 21-28, 1960
DETROIT, MICHIGAN

EXPOSITION COMMITTEE
American Society of Tool Engineers
10700 Puritan Ave., Detroit 38, Michigan

UNiversity 4-7300

GADGETS CONTEST

If you've thought up an interesting device that makes toolroom or production jobs easier, safer or more efficient, get it ready for the Gadgets Contest, beginning October 1.

Entries for the contest will contain ideas that are real practical value to tool engineers. They are ideas you won't find in any handbook, but they are valuable contributions to America's productive knowhow.

Take a look at the Gadgets in the Gadgets Section of any issue of **THE TOOL ENGINEER**. They are typical of the sort of idea we are talking about.

Then sharpen your pencil and get to work. Write a brief description of your Gadget, make a sketch and get your gadget ready to send along. You may win one of the seven cash prizes and you'll have the satisfaction of knowing that your idea may be real value to fellow tool engineers.

GADGETS CONTEST RULES

1. **ELIGIBILITY:** This contest is open to all members of the American Society of Tool Engineers.
2. **DEFINITION:** "Gadgets" are defined as tools or methods developed to solve specific production problems. They should contain a useful and practical idea or indicate an ingenious solution to a tool engineering problem.
3. **PRIZES:** One \$100 first prize, two \$50 second prizes, four \$25 third prizes, and honorable mention awards which will be a choice of the Tool Engineers Handbook, 2d Edition, or Die Design Handbook published by the American Society of Tool Engineers. Certificates will be awarded to all prize winners.
4. **PERIOD:** The contest will run from October 1 until December 31, 1959. All contributions to the Gadgets Department received from ASTE members during the period of the contest will be considered as entries.
5. **JUDGING:** Entries will be judged on the basis of originality and usefulness to other tool engineers. Also, clarity of illustrations, conciseness and completeness of presentation will be considered. Members of the ASTE National Editorial Committee will serve as judges. Winners will be notified by mail as soon as possible after completion of judging. A list of winners will be published in **THE TOOL ENGINEER**.
6. **ENTRIES:** The name and chapter affiliation of the author should be written on each page of the entry. No entries will be returned. Information which has been published previously in a periodical or national magazine is not eligible. All publication rights are assigned to **THE TOOL ENGINEER**. Authors of entries published in **THE TOOL ENGINEER** will receive honorariums.
7. **LENGTH:** Entries should be limited to 500 words or less. Sketches or photographs should be used to illustrate the methods or devices described in the text of the entry.
8. **MAIL ENTRIES TO:** Gadgets Contest Editor, **THE TOOL ENGINEER**, 10700 Puritan Ave., Detroit 38, Mich.

Bodine

CASE HISTORY No. 49

showing what **ONE** versatile Bodine
is doing for MANNING, MAXWELL & MOORE, Inc.

PARTS:

One is brass, the other tough
AISI 347 Stainless Steel.

OPERATIONS:

Drill, chamfer and tap
(#8-32) two holes 3/16"
deep.

PRODUCTION:

Brass, 800/50 min. hour,
Stainless, 175/50 min. hour.



PARTS:

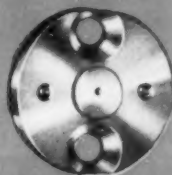
Brass.

OPERATIONS:

Drill and countersink two holes,
.173" dia. with .350" .82" coun-
tersink. Also drill and tap
(#2-56) two holes.

PRODUCTION:

1500/50 min. hour.



PARTS:

Forged brass gauge-sockets.

OPERATIONS:

An unusual feature is two-step drilling of
two holes . . . first 1/2-way through, using
#37 (.104") half-round drills with bush-
ings; then drill through and chamfer in
one operation, using combination half-
round drills. By this method tolerances on
hole centers are held to $\pm .001$ " on the
entry and $\pm .003$ " on exit side after drill-
ing through 9/16" of stock. Tap some two
holes #6-32 9/32" deep. Mill slot .133"
($\pm .002$ ") wide x .156" deep with hori-
zontal milling spindle and 4" saw-type
cutter. Drill hole from bottom of milled
slot #44 (.086), 5/16" deep.

PRODUCTION:

Position and clamp; auto unclamp and
auto eject; 1250 pieces per 50 min. hour.



PART:

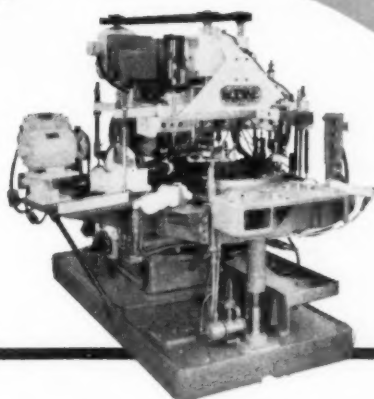
Stainless Steel (AISI 347).

OPERATIONS:

Drill, chamfer and tap (#2-56) two holes
3/16" deep.

PRODUCTION:

150/50 min. hour.



**All these parts and operations on ONE
machine with only TWO dial changes!**

Here is a good example of Bodine versatility . . . and especially
of the ability of a single Bodine Basic Machine to handle exacting
jobs of widely differing shapes, sizes, materials and operations . . .
with changeover reckoned in minutes rather than hours.

All of these parts are processed with only two dial changes.
Spindles, other accessory equipment, and tooling are also basically
standardized Bodine units. Retooling for possible future part and
operation changes will be relatively simple and inexpensive . . . an
important Bodine feature.

Isn't this the kind of time-saving, cost-cutting production engi-
neering you, too, are looking for? If so, do not hesitate to ask us for
production analysis of your next job. Write Dept. TE-9.

TE-9.

THE
Bodine
CORPORATION
BRIDGEPORT 5, CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING,
TAPPING, AND SCREW INSERTING MACHINES

Beat the Heat Barrier With Handy & Harman High Temperature Brazing Alloys!

Some of the problems of elevated temperature joint strength and oxidation resistance in heat-resistant alloys are being solved today by a relatively new group of Handy & Harman high temperature brazing alloys. These alloys embody certain unique characteristics, all of which are requisite for high temperature brazing:

- They have good strength and oxidation resistance at recommended temperatures.
- They are ductile, with the ability to withstand vibration and stress at elevated temperatures.
- These Handy & Harman alloys provide minimum solution and penetration of the metals being joined; this is a particular advantage when joining thin sections.
- These alloys effectively join stainless steels, low alloy steels, nickel-base alloys, cobalt-base alloys and other high temperature metals including refractory types.

The list of successful applications includes jet engine parts, heat ex-

changers, rocket motors, clad metals, honeycomb structures, turbine blades and many others. The following are brief descriptions of these Handy & Harman alloys:

LITHOBRAZE 925 For short time operation to 900° F, continuous at 500° F. Very ductile, virtually no solution of base metal. Good salt-spray corrosion resistance.

HI-TEMP 30 For continuous service 900° F-1000° F. Fairly ductile, moderate general solution of base metal.

PREMABRAZE 128 Continuous service up to 1500° F. Ductile, moderate solution of the base metal. Tensile strength at 1600° F in 304 stainless steel is 20,000 psi (short time test).

PREMABRAZE 130 Same properties as PREMABRAZE 128, but freer flowing and lower brazing temperature.

PREMABRAZE 101 Continuous operation in 1800° F-2000° F range (based upon limited oxidation tests). Ductile, moderate solution and penetration of the base metal.

Alloy	Nominal Composition				mp° F	fp° F
LITHOBRAZE 925	92.5	Ag	7.3	Cu .2 Li	1435	1635
HI-TEMP 30	70	Mn	30	Ni	1885	1920
PREMABRAZE 128	72	Au	22	Ni 6 Cr	1785	1900
PREMABRAZE 130	82	Au	18	Ni	1740	1740
PREMABRAZE 101	54	Pd	36	Ni 10 Cr	2250	2300

Data sheets and complete details on each of the above Handy & Harman alloys are available upon request to Handy & Harman, 82 Fulton Street, New York 38, N. Y.

Your NO. 1 Source of Supply and Authority on Brazing Alloys OFFICES AND PLANTS

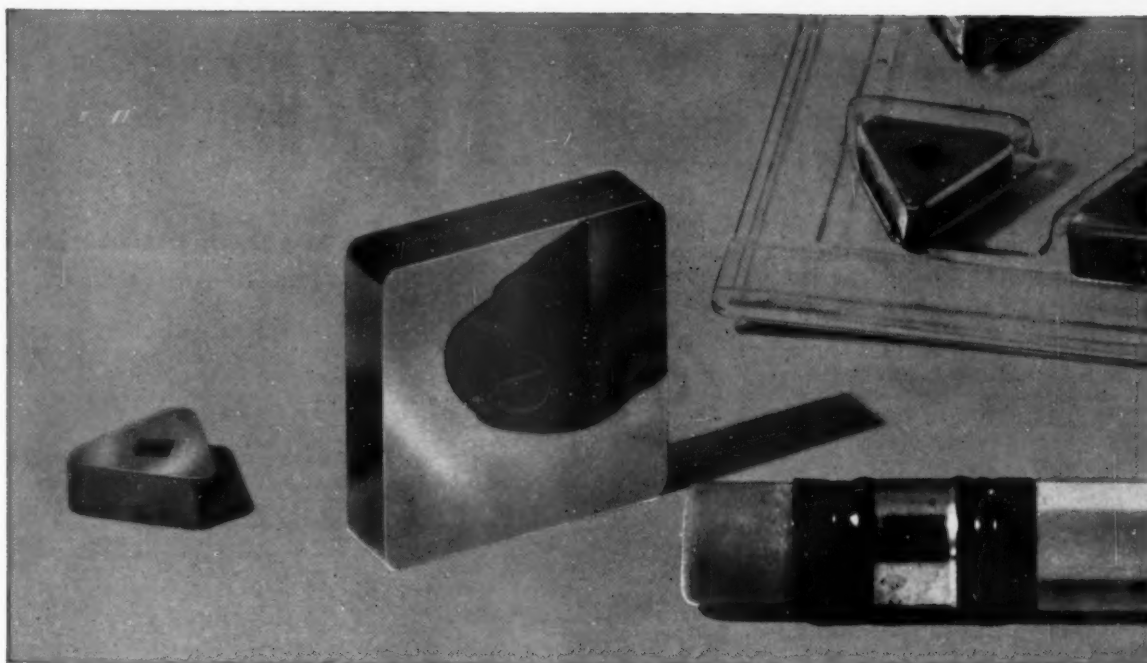


HANDY & HARMAN

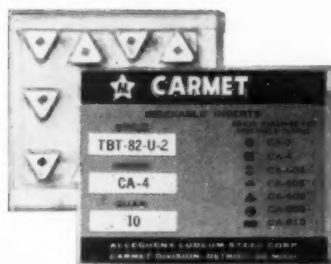
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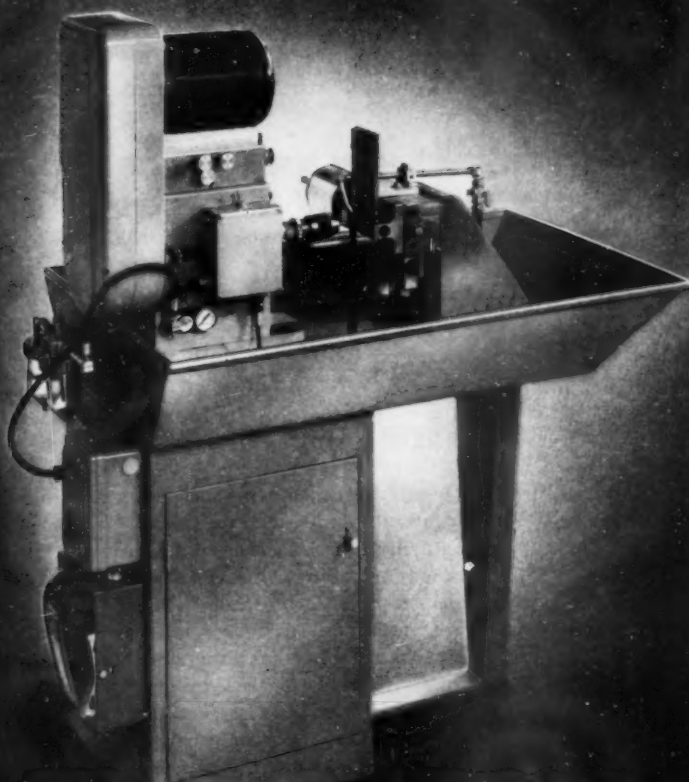
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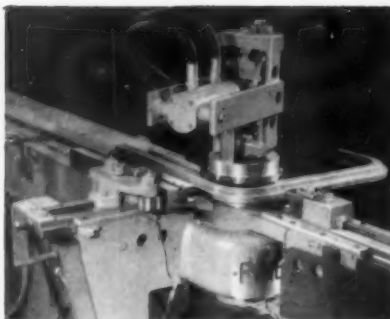
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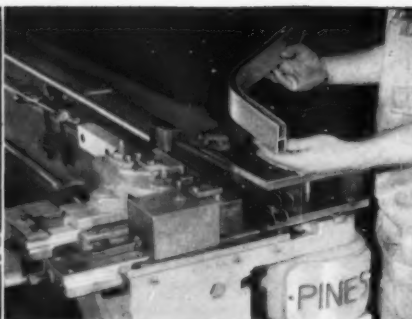
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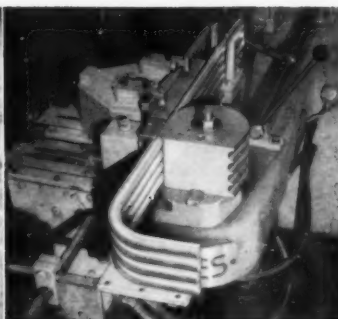
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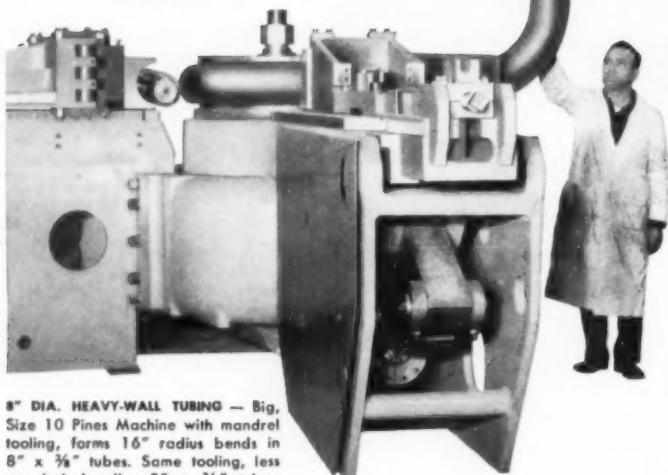


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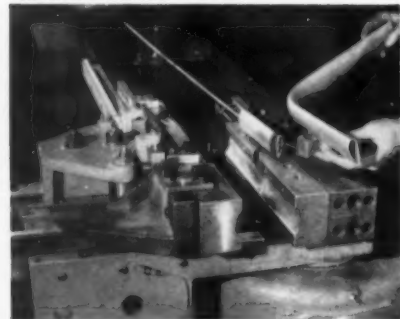
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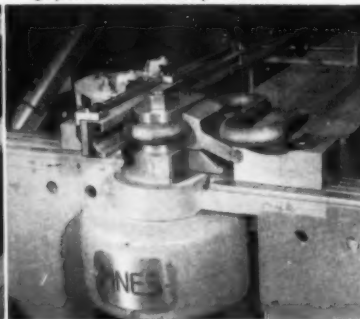
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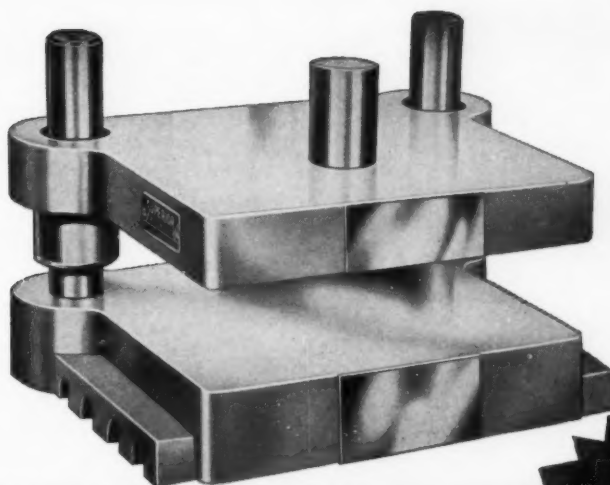


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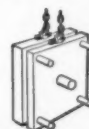
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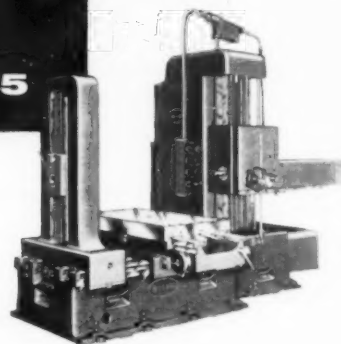
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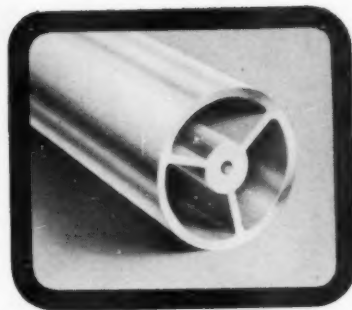
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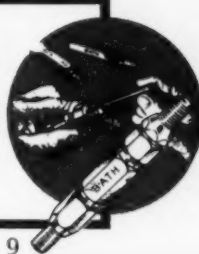
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The Tool Engineer



BATH *Tap'n Gage* TIMES

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Vol. 1

No. 9

Subject: Tap Pitch Diameters for Classes 2, 3, 2B and 3B

The tap pitch diameter (H limit number) necessary to produce a given class of fit is dependent on many factors other than the tap. The recommended limit numbers normally pro-

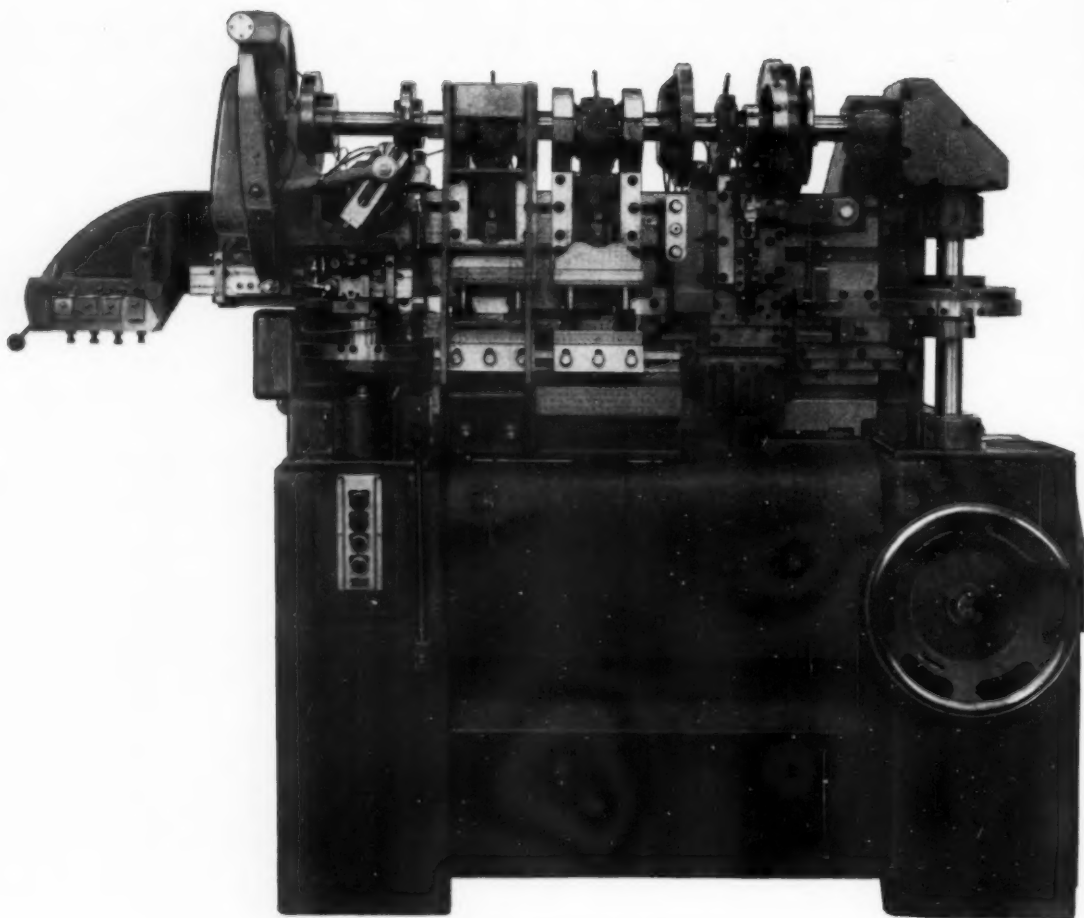
duce the class of thread as listed when used in average materials with reasonable care. If an unsatisfactory gage fit results, a choice of some other limit tap may be necessary.

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Size	Threads Per Inch		Recommended Tap for Class of Thread				Pitch Diameter Limits for Class of Thread				
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0	..	80	H 1	H 1	H 2	H 1	.0519	.0536	.0532	.0542	.0536
1	64	..	H 1	H 1	H 2	H 1	.0629	.0648	.0643	.0655	.0648
1	..	72	H 1	H 1	H 2	H 1	.0640	.0658	.0653	.0665	.0659
2	56	..	H 1	H 1	H 2	H 1	.0744	.0764	.0759	.0772	.0765
2	..	64	H 1	H 1	H 2	H 1	.0759	.0778	.0773	.0786	.0779
3	48	..	H 1	H 1	H 2	H 1	.0855	.0877	.0871	.0885	.0877
3	..	56	H 1	H 1	H 2	H 1	.0874	.0894	.0889	.0902	.0895
4	40	..	H 2	H 1	H 2	H 2	.0958	.0982	.0975	.0991	.0982
4	..	48	H 1	H 1	H 2	H 1	.0985	.1007	.1001	.1016	.1008
5	40	..	H 2	H 1	H 2	H 2	.1088	.1112	.1105	.1121	.1113
5	..	44	H 1	H 1	H 2	H 1	.1102	.1125	.1118	.1134	.1126
6	32	..	H 2	H 1	H 3	H 2	.1177	.1204	.1196	.1214	.1204
6	..	40	H 2	H 1	H 2	H 2	.1218	.1242	.1235	.1252	.1243
8	32	..	H 2	H 1	H 3	H 2	.1437	.1464	.1456	.1475	.1465
8	..	36	H 2	H 1	H 2	H 2	.1460	.1485	.1478	.1496	.1487
10	24	..	H 3	H 1	H 3	H 3	.1629	.1662	.1653	.1672	.1661
10	..	32	H 2	H 1	H 3	H 2	.1697	.1724	.1716	.1736	.1726
12	24	..	H 3	H 1	H 3	H 3	.1889	.1922	.1913	.1933	.1922
12	..	28	H 3	H 1	H 3	H 3	.1928	.1959	.1950	.1970	.1959
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1 1/8	18	..	H 3	H 2	H 5	H 3	.2764	.2805	.2794	.2817	.2803
1 1/8	..	24	H 3	H 1	H 4	H 3	.2854	.2887	.2878	.2902	.2890
1 3/8	16	..	H 3	H 2	H 5	H 3	.3344	.3389	.3376	.3401	.3387
1 3/8	..	24	H 3	H 1	H 4	H 3	.3479	.3512	.3503	.3528	.3516
1 1/2	14	..	H 5	H 3	H 5	H 3	.3911	.3960	.3947	.3972	.3957
1 1/2	..	20	H 3	H 1	H 5	H 3	.4050	.4086	.4076	.4104	.4091
1 1/2	13	..	H 5	H 3	H 5	H 3	.4500	.4552	.4537	.4565	.4548
1 1/2	..	20	H 3	H 1	H 5	H 3	.4675	.4711	.4701	.4731	.4717
1 3/4	12	..	H 5	H 3	H 5	H 3	.5084	.5140	.5124	.5152	.5135
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1 3/4	..	16	H 3	H 2	H 5	H 3	.7094	.7139	.7126	.7159	.7143
1 3/8	9	..	H 6	H 4	H 6	H 4	.8028	.8098	.8077	.8110	.8089
1 3/8	..	14	H 4	H 2	H 6	H 4	.8286	.8335	.8322	.8356	.8339
1	8	..	H 6	H 4	H 6	H 4	.9188	.9264	.9242	.9276	.9254
1	..	12	H 4	H 2	H 4	H 4	.9459	.9515	.9499	.9535	.9516
1	14NS	..	H 4	H 2	H 6	H 4	.9536	.9585	.9572	.9609	.9590
1 1/4	7	..	H 4	H 4	H 4	H 4	1.0322	1.0407	1.0381	1.0416	1.0393
1 1/4	..	12	H 4	H 4	H 4	H 4	1.0709	1.0765	1.0749	1.0787	1.0768
1 1/4	..	7	H 4	H 4	H 4	H 4	1.1572	1.1657	1.1631	1.1668	1.1644
1 1/4	..	12	H 4	H 4	H 4	H 4	1.1959	1.2015	1.1999	1.2039	1.2019
1 3/8	6	..	H 4	H 4	H 4	H 4	1.2667	1.2768	1.2738	1.2771	1.2745
1 3/8	..	12	H 4	H 4	H 4	H 4	1.3209	1.3265	1.3249	1.3291	1.3270
1 1/2	6	..	H 4	H 4	H 4	H 4	1.3917	1.4018	1.3988	1.4022	1.3996
1 1/2	..	12	H 4	H 4	H 4	H 4	1.4459	1.4515	1.4499	1.4542	1.4522

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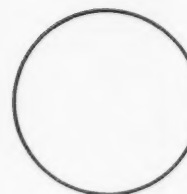
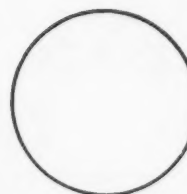
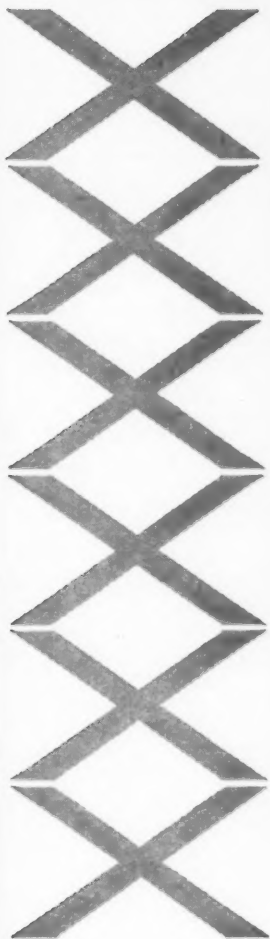
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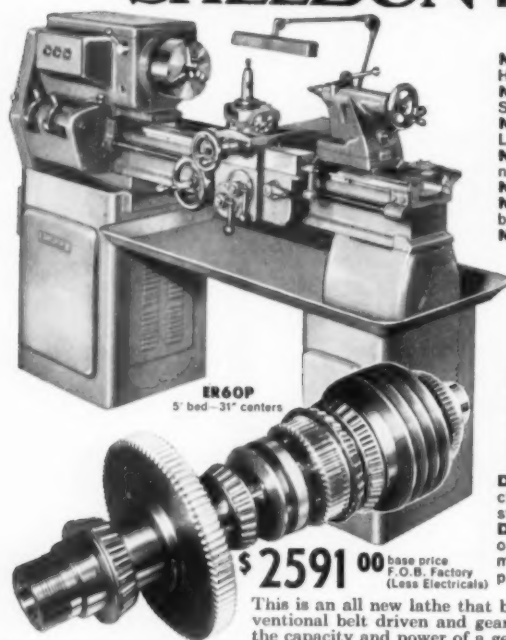
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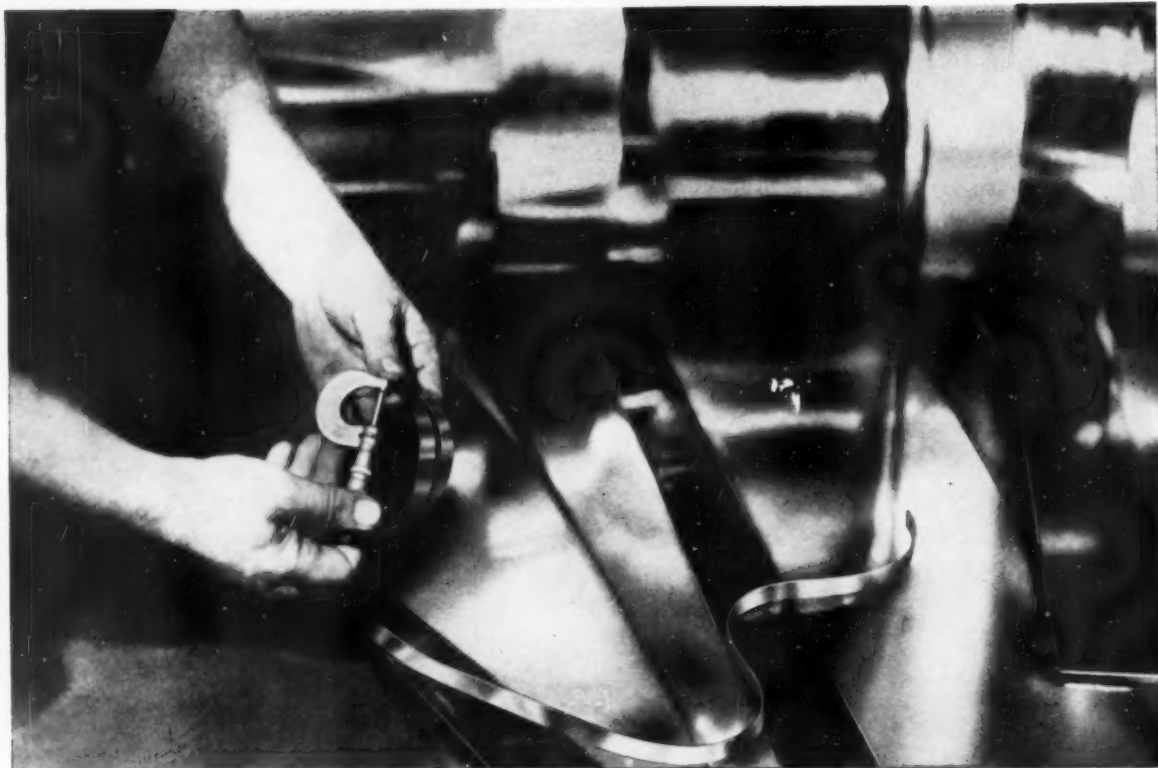
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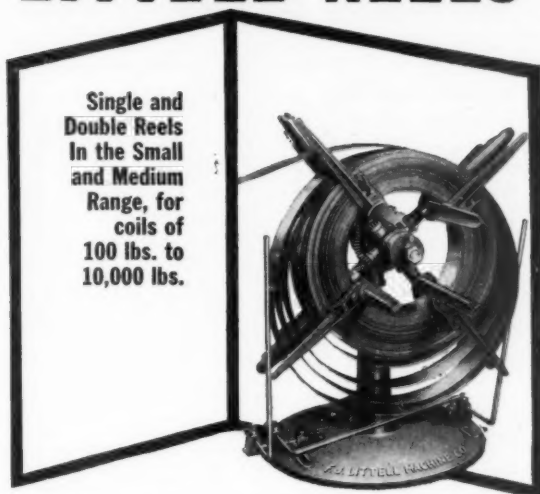


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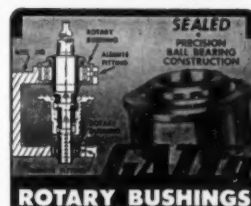
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September 1959

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LOOKING AHEAD

By T. W. Black
Senior Associate
Editor

Speed of gaging—especially where multidimensional measurements and complex shapes are involved—has often failed to keep pace with increases in speed of production. This has resulted in serious inspection bottlenecks and disproportionately high gaging costs.

Production of contoured aircraft parts by numerical control has, for example, resulted in impressive time and cost savings. Until recently, these parts have been inspected by time-consuming conventional methods.

Now several companies have developed numerically controlled gaging machines that are capable of matching the productivity of numerically controlled milling machines.

Input of these automatic inspection machines is on a control tape that positions a gaging head at a desired series of points on a workpiece. The head measures the deviation of the workpiece from its nominal (blueprint) dimensions.

One such inspection machine, the Pratt & Whitney Data-Limit, furnishes digital output data in the form of punched cards. Another, the Warner & Swasey Universal Probograph, records output data on a strip chart.

In addition to speed of operation, these machines eliminate the need for special gaging templates and tooling, thus reducing lead time and costs.

A solution for a vital industrial problem—increasing the useful life of high-cost machine tools and reducing obsolescence costs—has been met at least partially by agreement on a new "building-block" or unitized-design concept for production machine tools.

Manufacturing firms and major production machine tool suppliers have reached accord on a limited number of standard specifications for mounting and attaching surfaces of main bases, wing bases, feed units, horizontal angular adapters, vertical and angular columns; and for bolting patterns and work loading height.

The building-block concept, in practice, permits replacement of one or more sections of a production line with other standard sections to adapt the basic line to production of newly designed parts.

Median income for professional engineers rose to a record high of \$10,000 in 1958, according to an analysis of over 19,000 questionnaires by the National Society of Professional Engineers. Only 10 percent of the engineers listed incomes below \$7040; the upper 10 percent reported incomes of at least \$19,680.

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STYLE
264

Ex-Cell-O Precision Tool Grinder line includes: Style 264 (above), an electrolytic reciprocating model for lower-cost sharpening of carbide tools; and the similar Style 142 (not shown) for conventional grinding; the Style 146 finish grinder, which uses 6" plate-mounted wheels; Style 148, which uses 10" wheels for roughing and finishing larger tools; the Style 149, with 14" grinding wheels and heavy-duty Spindle; and the Style 144 finish grinder with Ex-Cell-O Precision Spindle. Style 264 and 142 provide automatic reciprocation for face grinding, and manual reciprocation for grinding chip breaker grooves.

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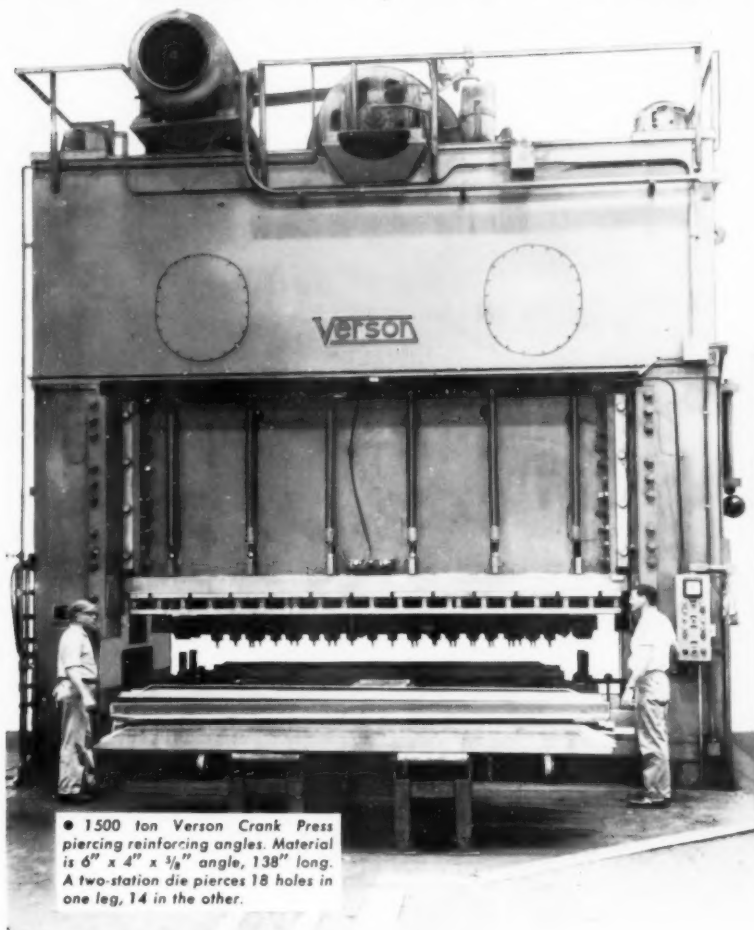
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While most people think of press versatility in connection with smaller presses, you can get versatility in big presses if you need it. You can get it, that is, if the press builder understands your production problems.

The Verson 1500 ton double crank press shown above is a good example. Installed in the Decatur (Ill.) plant of Caterpillar Tractor Co., it's a big press (bolster area 72" x 192", over 31' high, and weighing more than 180 tons). It operates at 16 strokes per minute. It is designed to J.I.C. specifications and features Verson Automatic Cascade lubri-

cation to all points of the press. It is used for blanking and piercing on a wide variety of construction equipment parts, with as many as four operations performed simultaneously.

Most important, though, it fits the production processes of the plant in which it is used. And we at Verson believe the process is more important than the press.

If you would like to see what production-consciousness can mean to you, ask your Verson representative to go over your requirements with you. It could be the first step to bigger profits.

Originators and pioneers of
 allsteel stamping press construction

VERSON ALLSTEEL PRESS CO.

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